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ORIGINAL ARTICLES

THE TREATMENT OF OPEN-BITE CASES

BY ALBERT H. KETCHAM, D.D.S., F.A.C.D., DENVER, COLO.

THE foundation for the successful treatment of a deformity or disease is laid in correct diagnosis. This axiomatic statement is true when approaching the study of a case of malocclusion of the teeth, especially one of those cases possessing characteristics which indicate an unfavorable prognosis.

A complete diagnosis is impossible without a broad knowledge of causes, and as this paper deals primarily with treatment, let me, before taking up treatment, call your attention to recent writings which deal with the importance of a correct understanding of etiology. These essays are worthy of your most careful study.

First, James David McCoy in the third edition of his book, *Applied Orthodontia*[1] which is just off the press, deals with the subjects of growth and development or biology in a comprehensive manner. He says in part:

"We should not fall into the error of attempting to segregate our special field from the rest of the body, for the study of growth and development in all its phases is necessary to a correct comprehension of some of our most important problems."

Second, a paper given by Clinton Howard at last year's meeting of this Society,[2] in which he emphasizes the necessity of a more careful consideration of the biologic aspects of the treatment of our cases, rather than the purely mechanical as we have in the past.

Third, a paper by Milo Hellman,[3] who has graciously furnished me a copy of his manuscript. In making a strong plea for an intensive study of growth, he says in part:

Read before the American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

"It would seem that growth is the predominating factor in the establishment of occlusion as it is in the development of the entire individual. But growth is not constant and definite. It varies in intensity, it varies in time, it varies in direction and it varies in different structures and in different parts of the same structure. An adequate knowledge of growth is therefore indispensable. But growth cannot be controlled. It is therefore also necessary to recognize our limitations."

Hellman shows in a study of the measurements he made of several groups of individuals that in those who had open-bite the body of the mandible and also the ramus are short when compared with the average measurements of those in the same group who have normal dentition. Furthermore, the total face height in the open-bite individuals is greater than the average for the same group who do not have open-bite.

These observations should stimulate further study of the abnormal influences of the involved muscles upon the mandible and skull. Alfred Rogers[4] and Homer Robison[5] should be able to help us in understanding the reason for the maldevelopment of the mandible.

I agree with the conclusions of Drs. Howard and Hellman. However, I should like to inject a further thought into the discussion of the etiology of open-bite cases which is pertinent to all malocclusions, namely, the consideration of the part played by nutrition.

We know that growth and development of bone have been gradually brought about through the ages by function and nutrition. Now if function, or the pull of the attached muscles, plus nutrition, has developed bone to its present form, it then must be reasonable to assume that if these factors are normal, then the form and size of the bone will be normal. However, if there is abnormal function or nutrition, even to but a slight degree, it results in abnormal bone development.

Hojer,[6] in an excellent monograph on the subject, states that when *almost* enough of the antiscorbutic factor is furnished for the body requirements yet *not* enough, no pathology is to be found in the body *except in the teeth*. This represents a condition of latent antiscorbutic deficiency which often exists but that has been unrecognized.

Percy Howe[7] shows that when monkeys are fed a diet deficient in mineral salt and vitamins, a condition of depletion of the lime salt content of the bones and of the teeth of the animal is produced.

John A. Marshall has made similar observations.[8] A paper he gave in 1927 deals with the subject in clear and forceful language, making the temptation to quote irresistible. He says:

"Animals instinctively choose the right food. We, as animals, should do so, but don't. The senses of smell and taste have become perverted. We live in a somewhat superficial age where things must possess certain flavors, must give out certain aromas, before they are palatable. One of the effects of civilization has been pure food, but the pure food has also been poor food. The uncivilized races, whatever their sins of personal hygiene may have been, ate food which contained all the necessary elements for the upbuilding of the body.

"This problem of body-building is not entirely dissimilar from that of building a house. For example, we start in with our concrete foundation; then follow in regular order timbers, boards, lathe, shingles, plaster, nails and paper. In order to maintain the house, we have to repaper, replaster and reroof. Now consider the analogy. During the growth period of life, we start in with milk, vegetables, bread, butter, meat and fruit. From these raw materials, properly selected in accordance with quality as well as quantity, we may successfully build our physiologic house—the body. However, some of us insist on using all mortar, all lathe, all nails or all shingles."

Walter H. Eddy, in a paper presented before the District of Columbia Dental Society,[9] showed through animal experimentation that where the vitamin content of the diet was low the structure of the dentin was atypical and that the animals suffered from scurvy. When the vitamin content of the diet was increased by a moderate amount, the structure of the dentin improved and the scurvy disappeared. Upon increasing the vitamins to the maximum, the dentin deposited was normal.

My studies in the absorbed tooth root problem have led me to believe that in the majority of our patients nutritional disturbances are present.[10] A poorly balanced diet is almost the universal rule. Occasionally there is a child with faulty metabolism who is unable to assimilate a well balanced diet. The result of the work of scientists in the subject of nutrition leads us to believe that many of the children who come to orthodontists suffer from malnutrition. Usually the muscles of mastication are weak, or a group of muscles may be overdeveloped and functioning abnormally. In these cases the orthodontist should not merely make a record of the case, then dismiss the patient for months, or until such a time as there is an accelerated period of growth; but on the contrary he should, with the aid of the pediatrician, the internist or the physician versed in endocrinology, endeavor to find the cause of the child's abnormality. A sincere effort should be made to correct pernicious habits. The matter of metabolism and diet, under medical specialists, should receive due attention; muscle training, as advised by Rogers and Robison, should be definitely carried out. Thus periods of growth which have been retarded may be accelerated and successful orthodontic treatment instituted.

It is true, as observed by Dr. Samuel J. Lewis in his work upon young children at the Merrill-Palmer School in Detroit,[11] that an otherwise normally developing young child, who through some habit such as finger or tongue sucking has acquired the so-called open-bite condition, may, provided that the occlusion of the posterior teeth is correct and the original cause or causes have been overcome, be so fortunate as to have the malocclusion correct itself.

In the study of an open-bite or infraclusion case all available aids to a correct evaluation of the causative factors must be employed. Models possessing a high degree of accuracy are essential, also complete intraoral and extraoral roentgenograms of the teeth and jaws. In addition, a profile roentgenogram showing the positions of the teeth in relation to the bones of the face and the overlying soft tissues is often of great value. At least four photographs including the face and head should be secured; viz., one of the right profile and one of the left, one full face when in repose and another smiling, showing the teeth.

A close-up view with the lips held open is also of value in delineating detail of the area of the open-bite. (Fig. 1.) We should compare all the above with the patient "in person." Factors such as finger and tongue sucking must be considered. The size of the tongue and its excursions between the maxillary and mandibular teeth should be noted to determine if an abnormal force is exerted by this organ, and if so in which direction; viz., is it causing an upward and outward pressure against the maxillary anterior teeth alone, or a downward and outward pressure against the mandibular anterior teeth, or both?

The relation of the apparent infraclusion of the anterior teeth to the posterior teeth should be studied to determine if the latter are in supraclusion. A requisite part of the diagnosis would be a determination of the normal posi-

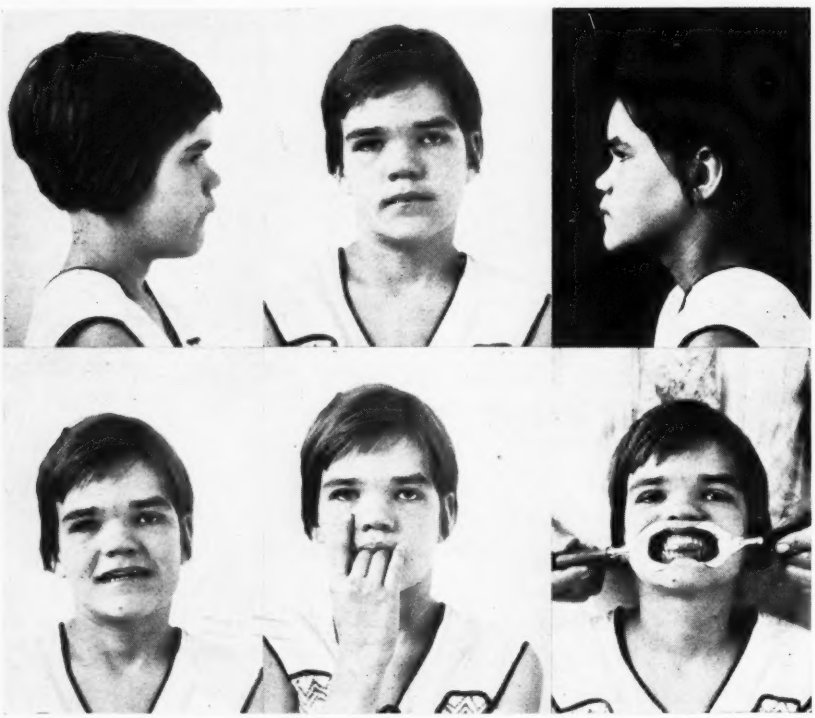

Fig. 1.—The value of a study of the photographic record of a patient's face before treatment is emphasized by the six photographs of the eleven-year-old girl shown above.

Note the overdevelopment of the upper lip and its resemblance in contour to that of a nursing infant. Note the eyes and nose.

Finger sucking is alternated with tongue sucking.

There was a lingual constriction of the maxillary arch in the right buccal region, evidently due to pressure of thumb and index finger of right hand against face while in act of sucking second and third fingers..

tion of the occlusal plane from the point of the beginning of the open-bite on one side to the point of occlusion on the opposite side.[12] It is also necessary to note the anteroposterior and buccolingual relations of the mandibular molars to the maxillary.

In attempting to fill the assignment of treatment of open-bite cases, three cases which were treated years ago will be shown, and one in which but a comparatively short time has elapsed since the period of retention or postoperative treatment. These cases differ essentially the one from the other. The patients were all beyond the age of any hope of self-correction, even if the causative fac-

tors had been overcome. All presented conditions more extreme than the average. I am presenting these cases with the realization that all causative factors were not recognized. The technic followed in treatment, on account of time limitations, can be mentioned only in a general manner, and likewise the illustrations must be limited in number.

The roentgenograms of each case herein reported, excepting the first, of which none were secured except in the molar region, show there was but a slight degree of root end resorption.

The face height in the first two cases indicates supraclusion of the molars; this may also be true of the third and fourth cases.

It may be that habitually holding the tongue between the incisal ends of the maxillary and mandibular anterior teeth always permits the buccal teeth to

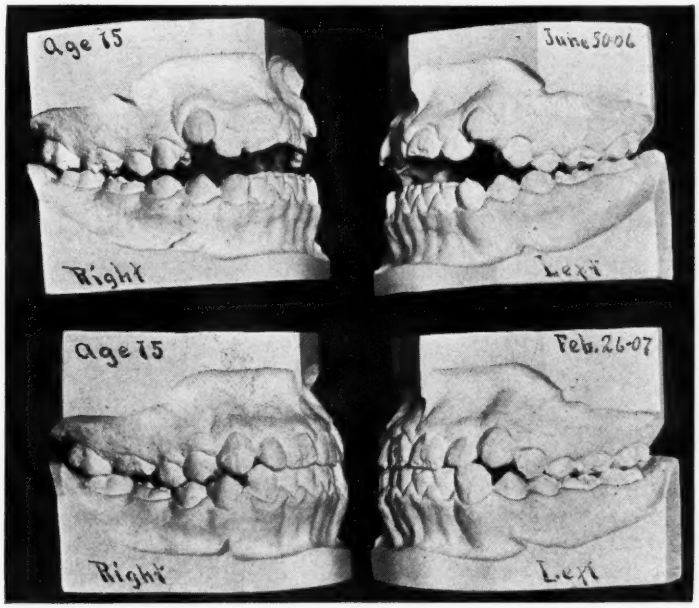

Fig. 2.—Case 1. Open-bite, enlarged tongue, hypoplastic enamel of occlusal surfaces of first permanent molars and also of incisal ends of maxillary and mandibular incisors and canines. (Models June, 1906.)

Case was treated in 1906-1907, using the Angle D molar clamp bands and E expansion arches. Result shown by models, February, 1907.

assume positions of supraclusion. The measurements of Hellman and also those of Simon[13] are an aid in determining if the patient's face is longer than the norm or average. However, the final decision in regard to the effect of the length of face upon personal appearance must be left to the artistic judgment of the operator, who should study the art relation of the patient's face not only to the head but to the stature as well. The realization of the operator's artistic ideals may be modified through mechanical appliances which are inadequate to reduce the supraclusion of the buccal teeth. Norris C. Leonard[14] has, previous to this, shown cases in which he has apparently reduced the supraclusion of the buccal teeth. He is to discuss this paper and will describe his technic.

Let me now give briefly a description of the cases above referred to.

CASE 1.—Fig. 2. Male, age sixteen years, neutroclusion. Enlarged tongue pressing upward against the anterior maxillary teeth. The maxillary teeth on the right side from the central incisor back to the first permanent molar, and on the left side from the central incisor back to the second premolar, were in infraclusion. Hypoplastic enamel was present on the occlusal surfaces of all first permanent molars, the incisal ends of the maxillary central incisors and also the mandibular incisors. There was a constriction of the maxillary arch from the second premolars forward. The lingual positions of the right maxillary premolars and first molar indicate external pressure.

Treatment was started in June, 1906, using the early type Angle molar clamp bands and expansion arches.[15] Fig. 3. Upon the maxillary teeth the molar clamp bands were fitted to the first permanent molars with the buccal tubes aligned to bring the expansion arch on a plane along the incisal third of

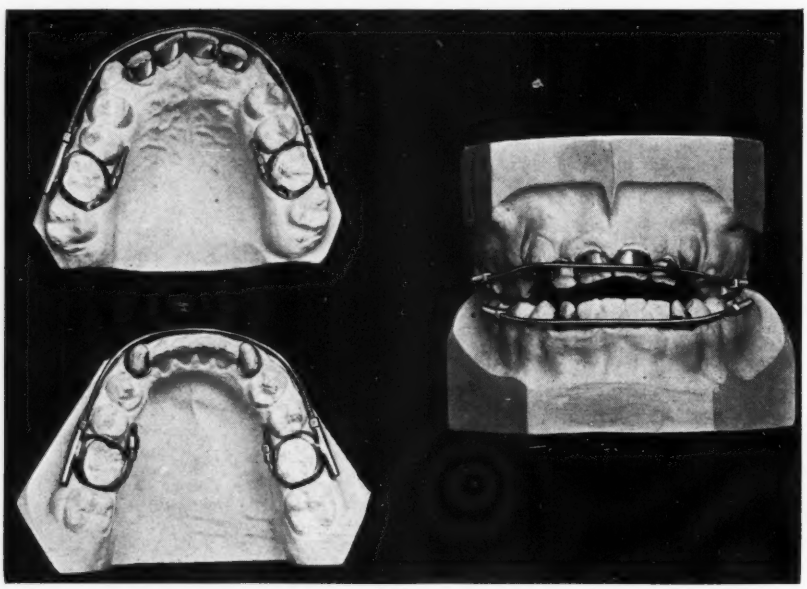

Fig. 3.—Case 1. Reproduction of appliances used in the treatment of this case.

the central incisors. The arch was adjusted to stand labially from the central incisors about one millimeter. Bands were placed upon the maxillary incisors, each band having a hook on the labial surface near the labiocervical margin for the reception of wire ligatures. The ligatures were tied to the arch with enough pressure to bend it cervically about one millimeter, thus exerting pressure outward and downward upon the incisors. At the same time, the first premolars were ligated to the arch to secure expansion in that region. In the second premolar region expansion was secured through the end of the molar clamp band bolt on each side of the mouth resting against the lingual surface of the second premolar. As expansion of the maxillary arch was secured and the incisors moved downward, the arch wire was adjusted by bending downward to induce further movement of the anterior teeth. Then the canines were banded to permit of ligating to the arch and were brought down into position, at the same time the left canine was rotated.

Upon the mandibular teeth the expansion arch was adjusted to stand about one millimeter outward from the mandibular central incisors and canines. Bands were placed on the canines, with hooks at the distolingual angle for the purpose of rotating these teeth. The mandibular incisors, canines and first premolars were ligated to the expansion arch to secure development in that part of the dental arch, after which rotation of the canines was completed. The nuts upon

Fig. 4.—Case 1. Shows profile of face before treatment on left, and immediately after active period of treatment on right.

Note that the lower portion of the face apparently shows too great a vertical development at this time. However, by the time the boy reached the age of twenty-three years he had grown to be six feet in height and broad in proportion, therefore, the disharmony of features was not so apparent. Unfortunately, photographs were not secured at this later age.

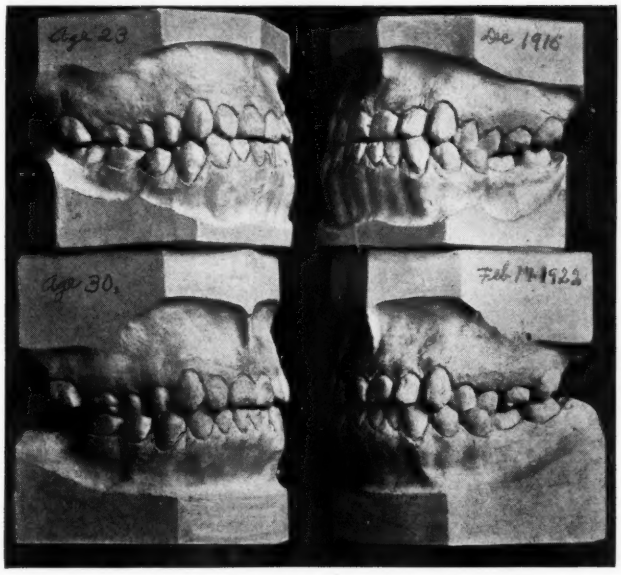

Fig. 5.—The models of Case 1 December, 1915, nearly nine years after treatment; and February, 1922, fifteen years after treatment. Note that while the maxillary arch has become somewhat constricted in the premolar region, and the mandibular arch has become overdeveloped in the premolar region, evidently due to the enlarged tongue being held in the floor of the mouth, the "open-bite" has not recurred.

both maxillary and mandibular expansion arch wires were kept in close contact with the tubes upon anchor bands during treatment.

Models of the case made in 1906, before treatment, and also in 1907, after eight months' treatment, are shown in Fig. 2. The profile view before treatment and a similar photograph taken immediately after the active period of treatment are shown in Fig. 4. The length of the lower part of the face would indicate

that the second molars are in supraclusion. Fig. 5 shows the models of the case made in 1915, nearly nine years after active treatment. There has been a lingual relapse of the maxillary premolars, and also a buccal movement of the mandibular premolars. Evidently the enlarged tongue has been held in the floor of the mouth and against the lingual surfaces of the mandibular premolars, producing overdevelopment of the mandible in that region and consequent displacement of these teeth. There probably would not have been so great a relapse had the patient been trained to hold his tongue against the roof of the mouth instead of allowing it to drop down into the floor. The young man at this time had grown to be a six footer and broad in proportion.

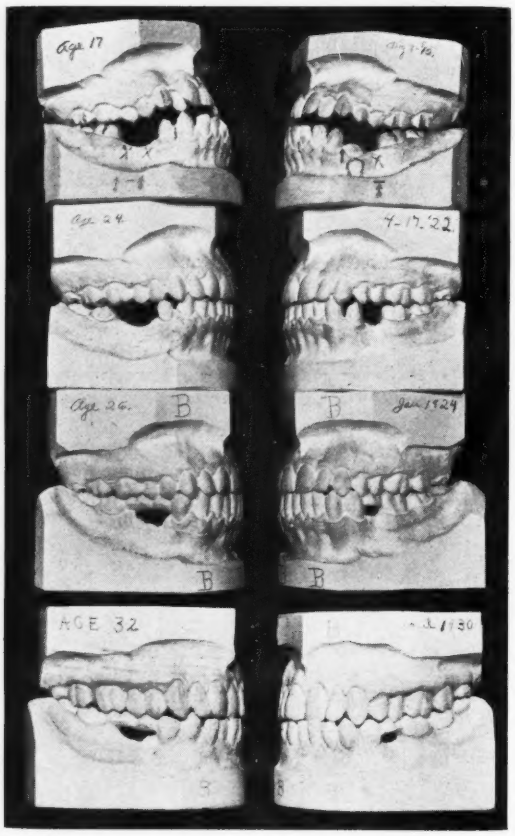

Fig. 6.—Case 2. Models dated August, 1915. Male, age seventeen years. Unilateral anteroclusion, modified through congenital absence of mandibular second premolars and loss of right mandibular first molar. Enlarged tongue held between maxillary and mandibular anterior teeth caused infraclusion of the maxillary anterior teeth, with labial inclination of both maxillary and mandibular anterior teeth. The mandibular molars have moved and inclined mesially.

Models made in 1922 at the time the few remaining retaining bands were removed. Models made in 1924, two years after the last of the retaining devices were removed, and the restoration of the missing teeth by bridges. Models made in 1930, thirteen years after the active period of treatment, show that there has been but slight relapse in the positions of the teeth, and that the "open-bite" malocclusion has not recurred.

The condition of the case fifteen years after treatment is shown by the models made in 1922, Fig. 5. The right mandibular second molar has been lost through neglect; a gold crown of the tin can or garden variety has been placed upon the right mandibular first permanent molar. The maxillary incisors have remained in occlusion all these years, being evidence that the tongue has not been held between the maxillary and mandibular incisors.

CASE 2.—Fig. 6. Models August, 1915. Male, age seventeen years. Unilateral anteroclusion, modified through congenital absence of mandibular second premolars and loss of right mandibular first molar. The overdeveloped tongue held between the incisal ends of the maxillary and mandibular teeth caused infraclusion of the maxillary anterior teeth, with labial inclination of both maxillary and mandibular anterior teeth, as shown by the profile roentgenogram, Fig. 7. The mandibular molars have moved and inclined mesially. While the

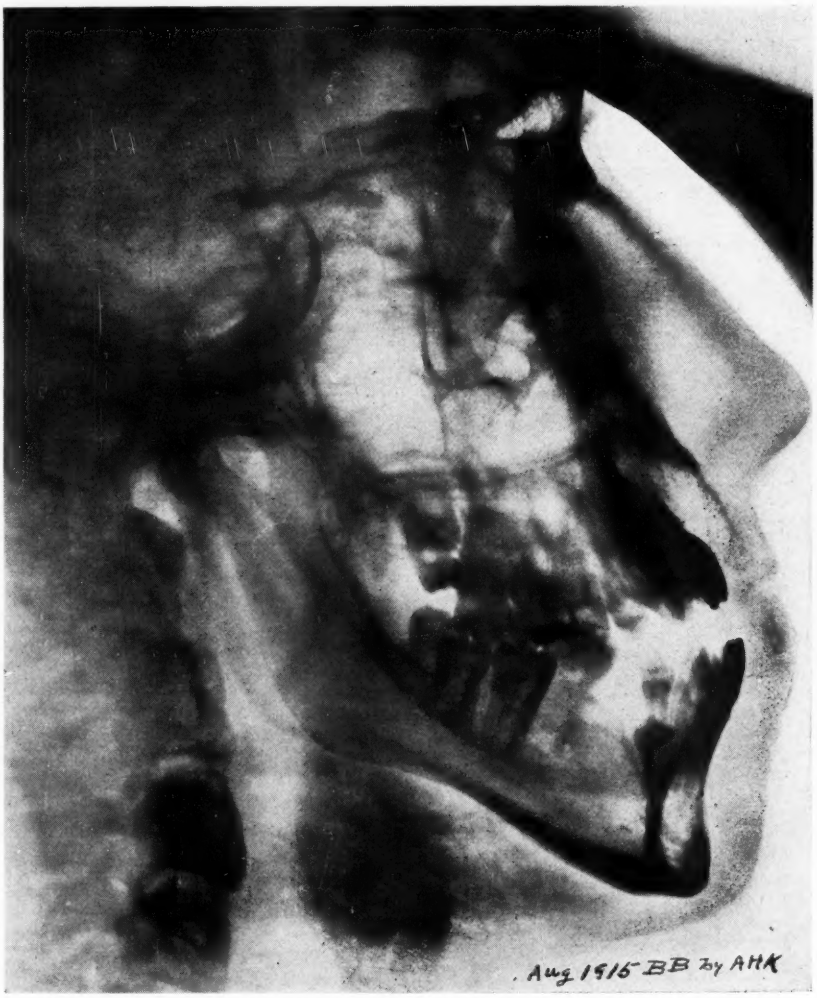

FIG. 7.—Case 2. Profile roentgenogram showing extent of open-bite and labial inclination of the maxillary and mandibular anterior teeth. This also shows the relation of the bones forming the framework of the face to the overlying soft tissues. (The artist has used the air brush on the print to strengthen the outline of the nose.)

left mandibular first deciduous molar was present, the roots were nearly absorbed. The unerupted first premolar was in correct position to erupt normally. The young man's face had a very dull, sluggish expression. (See Fig. 12A.) He was a little below average height, and 19 per cent below normal weight. He had been under the care of physicians nearly all his life, and was referred for further examination, but without success in locating the etiologic factors. Improvement in general nutrition and mental condition was shown during, and

immediately after, orthodontic treatment. A period of months elapsed following active treatment, during which time he was absent from Denver, without orthodontic or medical supervision. On his return it was observed that his improved general condition showed a relapse. At this time Dr. Clinton Howard was in Denver and was called in consultation. Dr. Howard advised consulting Dr. Engelbach, endocrinologist of St. Louis. This advice was followed, but it was too late to secure the best results. Had this patient been placed under the care of an endocrinologist early in life, probably the results would have been much better.

The mouth presented a very insanitary condition, gingivitis was present, superficial decay covered the labiocervical surfaces of all the teeth, though cavities had been filled. A periodontist, Dr. A. C. Hamm, removed the super-

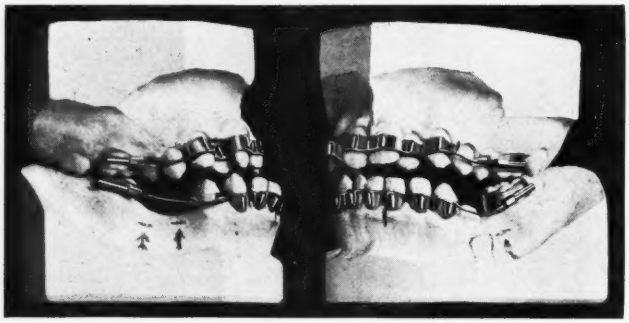

Fig. 8.

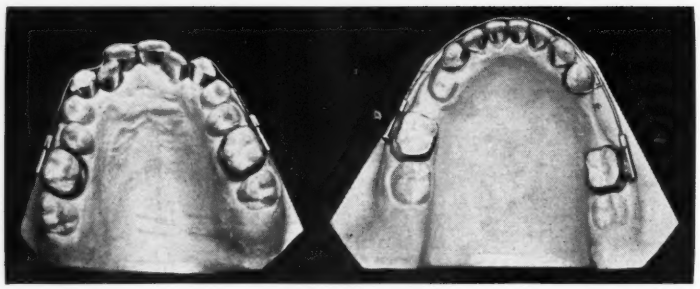

Fig. 9.

Figs. 8 and 9—Reproductions of the pin and tube appliances as used in the treatment of Case 2.

fical decay and polished rough enamel surfaces and secured good results in treating the inflamed gum margins. However, prognosis for successful treatment seemed unfavorable.[16]

Orthodontic treatment was started in August, 1915. Pin and tube appliances were constructed,[17] Figs. 8 and 9. The first objective was the expansion of the maxillary arch and the alignment of the malposed teeth, at the same time downward pressure was exerted upon the anterior teeth through the spring of the arch, in order to stimulate downward growth. In the mandibular arch the first endeavor was to move the molars on the right side distally into correct occlusal relations with the maxillary molars, and to move the left mandibular molars backward and upward into correct positions. To accomplish this the nuts in front of molar band tubes were tightened, and intermaxillary ligatures were used as is usual in treating Class III (Angle) cases.[18, 19] Fig.

10 shows the appliances adjusted upon the teeth, also the position of the tongue as it was habitually carried between the maxillary and mandibular anterior teeth. Fig. 11 shows the method employed near the end of the active period of treatment to aid in closing the open-bite, and to lessen the strain imposed upon the molars used for anchorage, by wearing intermaxillary ligatures from spurs upon the anterior portion of the maxillary arch wire to spurs upon the anterior portion of the mandibular arch wire.

The active period of treatment was one and one-half years, at which time appliances were changed to simpler form through removing the pins from the 0.030 diameter arch wire, shortening the tubes on the incisor and canine bands through grinding until only the upper one-half length remained. Wire ligatures were then passed through the remaining portion of each tube and tied around the arch wire. A few months later the appliances were removed, and to the lingual surfaces of the maxillary incisor bands tubes were attached in a horizontal plane so that a closely fitting 0.022 diameter round wire could be run through the tubes, and then each end of the wire was soldered to one of the canine bands, thus stringing the six anterior tooth bands on a wire, the

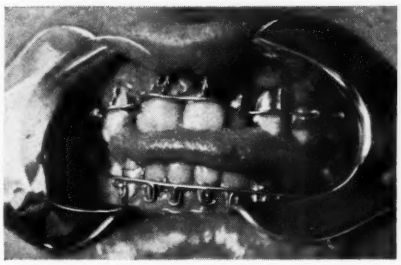

Fig. 10.

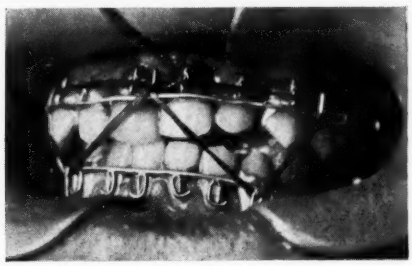

Fig. 11.

Fig. 10.—Case 2. Pin and tube appliance adjusted upon the teeth showing Butler latch hooks used to lock the pins upon the lower appliance in the tubes. This also shows the position of the tongue as it was habitually carried, between the maxillary and mandibular anterior teeth.

Fig. 11.—Case 2. The use of intermaxillary ligatures from spurs upon the anterior portion of the maxillary arch wire to spurs upon the anterior portion of the mandibular arch wire, to aid in closing the open-bite and also to lessen the strain imposed upon the anchorage teeth.

object being to retain width of the arch from canine to canine and to give some freedom of movement to the incisors while keeping them from returning to their original positions. For the retention of the mandibular molars and first premolars, a hinged retainer permitting some movement of the anchor teeth was constructed for each side to replace the missing teeth and to afford not only a space retainer but an occluding surface for the mastication of food.

Fig. 6 shows the models made in August, 1915, before treatment, and those made in 1922 shortly after the last retaining appliances had been removed. Those made in January, 1924, nearly two years after all retaining devices had been removed, show the skillful restoration of the missing teeth by bridges. I am fortunate to be able to show models of this case made from impressions taken by the patient's dentist the first of April, 1930, at the age of thirty-two years, more than fourteen years after treatment. You will note that there has been a slight relapse in the position of the left maxillary cen-

tral incisor. Evidently there is but little lateral movement of the mandible in chewing food. The result would indicate that the old pernicious habit of pressing the tongue between the mandibular and maxillary anterior teeth had been overcome and that the result of orthodontic treatment is satisfactory.

Fig. 12*A* shows the profile of the face at the beginning of treatment, seventeen years of age, *B* shows the profile at twenty-four years of age, *C* shows the profile at twenty-seven years of age. In the latter, note the appearance of senility.

CASE 3. Figs. 13 and 14. Models December, 1918, female, age twenty-four years, above average height, 27 per cent underweight, but always had been in good health. Posteroclusion, tongue habit. Maxillary anterior teeth protruding and in infraclusion. Maxillary arch constricted, also anterior part of mandibular arch constricted. The roentgenograms revealed that the left maxillary first permanent molar and the right mandibular first permanent molar were pulpless, with the appearance of apical infection. The occlusal surfaces of the molars were flattened, the result of imperfect fillings.

Fig. 12.—Case 2.-*A*, Profile of the face at seventeen years of age. Note the dull expression. *B*, Profile at twenty-four years of age. *C*, Profile at twenty-seven years of age. Note the appearance of senility.

The ribbon bracket appliances[20] were used in the treatment of both the maxillary and the mandibular teeth. Figs. 15 and 16. Bracket bands were placed upon the maxillary and mandibular incisors and canines. The maxillary molar anchorage bands were placed on the right first molar and the left second molar. The mandibular molar anchorage bands were placed upon the right second molar and the left first molar. The young woman was instructed to keep her tongue in its normal position in the roof of the mouth; evidently this was accomplished with success. The ribbon arch upon the maxillary teeth was adjusted to lie along the lower edge of the brackets upon incisor and canine bands and then sprung up into the brackets and locked in place. This stimulated a downward movement of the teeth and alveolus. Lateral expansion of the maxillary arch was secured through the spring force of the ribbon arch wire exerted upon the molars and through ligating the premolars to the arch wire. Downward growth of the maxillary anterior bone segment was aided by intermaxillary ligatures worn from hooks attached to the ribbon arch wire used on the maxillary teeth to the curved sheaths on the mandibular molar anchorage bands. This also stimulated forward movement of the mandibular

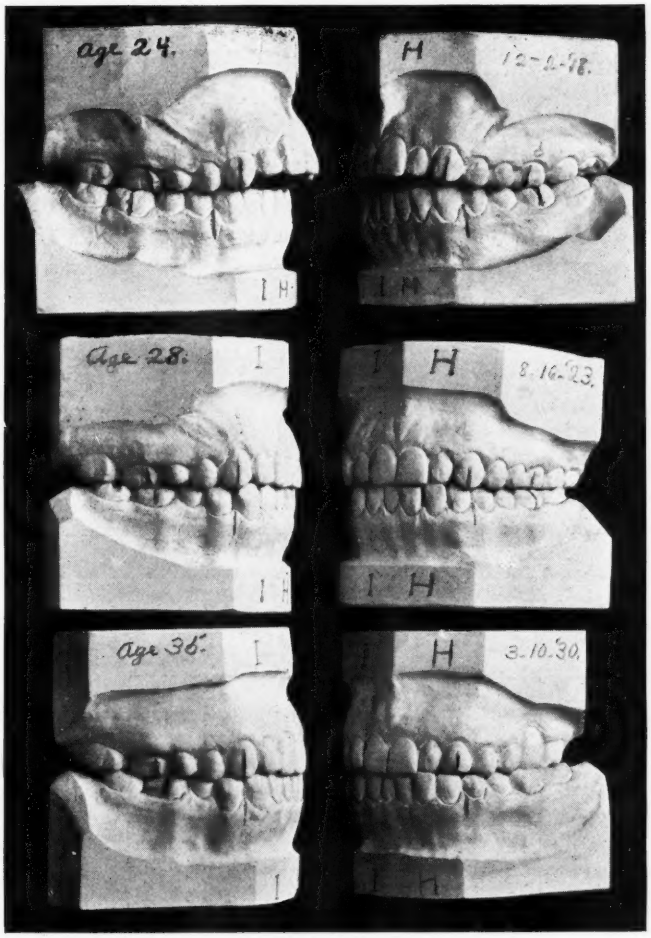

Fig. 13.—Case 3. Models 1918, before treatment. Female twenty-four years of age. Posteroclusion, tongue habit. Maxillary anterior teeth protruding and in infraclusion. The left maxillary first permanent molar and the right mandibular first permanent molar were pulpless.

Models made in 1923, at the time the last of the retaining bands were removed.

Models made in 1930, six and one-half years after all retaining appliances had been removed. The anterior-posterior cuspal relation of the mandibular to the maxillary teeth has remained normal. The anterior teeth have not relapsed toward "open-bite" malocclusion.

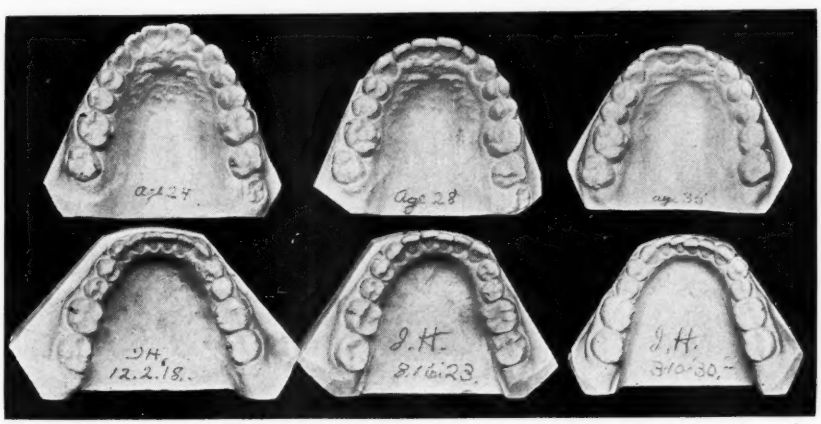

Fig. 14.—Case 3. Note that the occlusal surfaces of the molars are flat, the result of imperfect fillings.

There has been a slight relapse in the positions of the anterior teeth, as they are now somewhat crowded. Also there has been a relapse in the maxillary arch width in the left molar region, probably due in part to the short and imperfect molar tooth cusps.

teeth. Active treatment covered a period of about two years. Adjustments of appliances during this time averaged about once a month.

Retainers consisting of lingual arch wires attached to the molar bands, and the canine bands connected on lingual side by soldered wire were used on both the maxillary and the mandibular teeth, while bands with spurs were used to retain those incisors which had been rotated. Fig. 13 shows the models

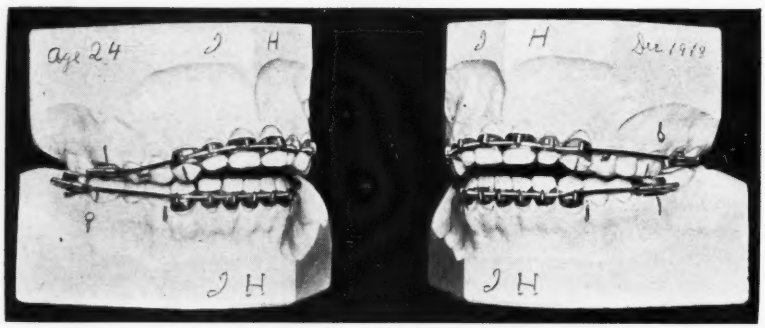

Fig. 15.

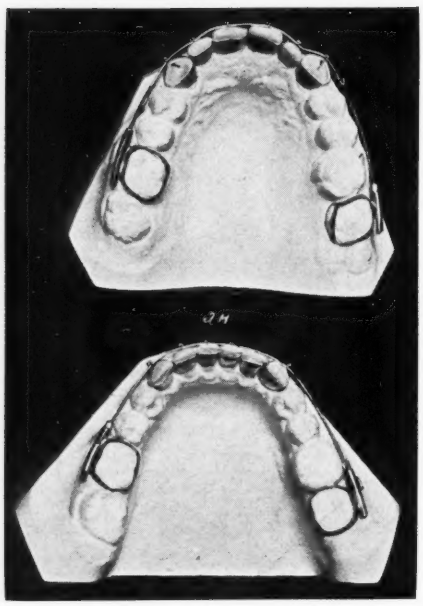

Fig. 16.

Figs. 15 and 16—Case 3. Reproduction of the ribbon bracket appliance as used in the treatment of this case.

of the case. Those made in December, 1918, before treatment, those made in August, 1923, at the time the few remaining retaining bands were removed, and those made in March, 1930, six and one-half years after all retaining appliances had been removed from the teeth. Note that the anterior-posterior cuspal relations of the mandibular to the maxillary teeth have remained normal, also that the anterior teeth have not relapsed toward the original open-bite condition. Fig. 14 shows the occlusal view of the same models. There has been a slight relapse in the positions of the anterior teeth in that they are now some-

what crowded, also in maxillary arch width in the left molar region, probably due in part to the short and imperfect molar tooth cusps.

A comparison of the profile roentgenograms, Fig. 17, the first, December, 1918, made before treatment was started, and the second made in March, 1930, nearly twelve years later, shows the improvement which has taken place in the contour of the bones forming the jaws and lower part of the face.

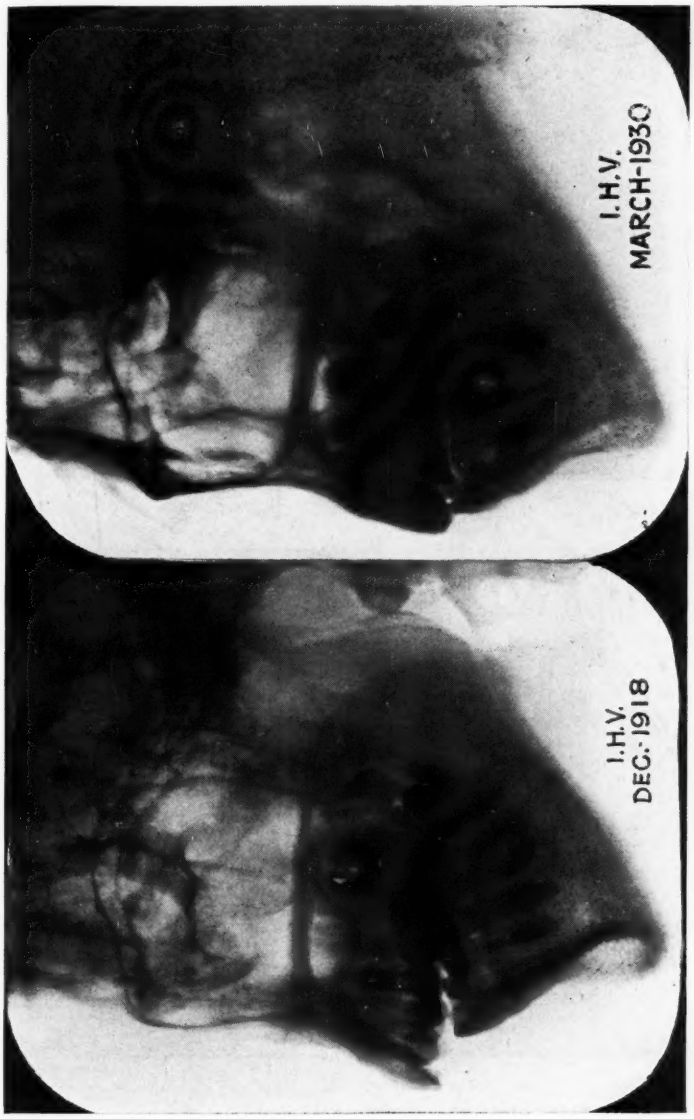

Fig. 17.—Case 3. Profile roentgenogram made in 1918 shows the contour of the bones forming the face and jaws before treatment of the malocclusion was started.

Profile roentgenogram made in 1930, twelve years later, shows the improvement which has taken place in the contour of the bones.

Case 4. Figs. 18 and 19. Models January, 1927. Male, age twenty-one and one-half years, below average in height, 11 per cent underweight, in fair health. History of pneumonia at two months of age. Thumb sucking, followed by tongue sucking. Posteroclusion. Infraclusion of the maxillary anterior teeth, due to abnormal pressure of the enlarged tongue. The occlusal surfaces of all first permanent molars were affected to an extreme degree by hypoplastic enamel. The incisal edges of the maxillary and mandibular incisors

and canines were also affected, and the rough ends had been ground off. The left maxillary lateral incisor was pulpless but had been treated and the root canal filled. The maxillary arch was quite narrow, and the mandibular arch was constricted in the anterior portion.

After studying the face, the malocclusion, and taking into consideration the poor structure of the maxillary first permanent molars, it was decided that the best procedure would be to extract these teeth. The mandibular first

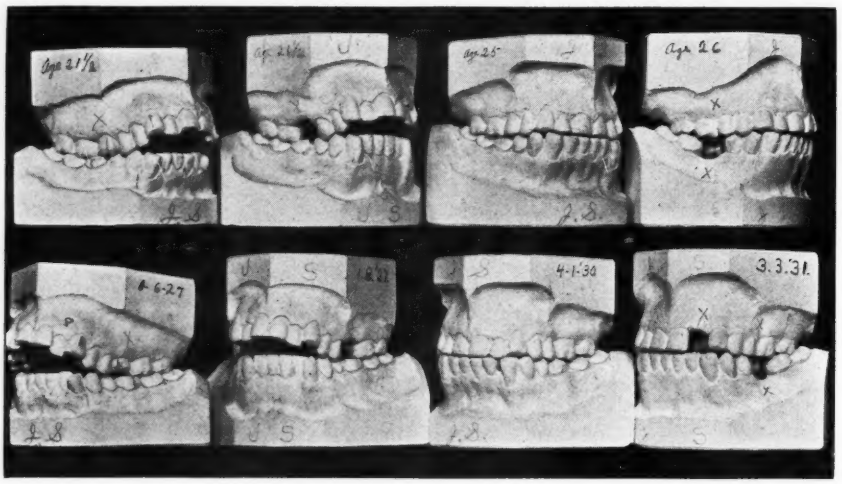

Fig. 18.

Fig. 19.

Figs. 18 and 19—Case 4. Models made in 1927, before treatment. Male twenty-one and a half years of age. Thumb-sucking early in life, followed by tongue-sucking. Posteroclusion. Infraclusion of the maxillary anterior teeth. Hypoplastic enamel affected the incisal ends of the maxillary and mandibular incisors and canines, also the occlusal surfaces of the first permanent molars.

Models made in 1930, at the time all retention was discontinued. Note that the mandibular anterior teeth have a labial inclination, presenting the appearance of an overtreated case.

Models made in 1931 show the appearance of the case after the extraction of the mandibular first permanent molars and the maxillary left lateral incisor. The maxillary second molars are now beginning to drop into the space resulting through the extraction of the mandibular first permanent molars, and they are also beginning to rotate.

molars were retained even though the pulps were nearly exposed and the alveolar crest showed absorption, as it was decided they would aid in our efforts to secure development of the mandible.

Treatment was begun in January, 1927, by Dr. R. L. Gray who at that time was an associate of Dr. Humphrey and myself. Upon the maxillary cen-

tral incisors and canines[21] bands were placed, with the hook attachment on the labial surfaces for the reception of the round arch wire, Fig. 20. The hooks afforded secure attachment for the small diameter round arch wire, while permitting freedom of tooth movement. The second molars carried the anchorage bands, Fig. 21. The anchorage bands had the buccal tubes aligned to correct

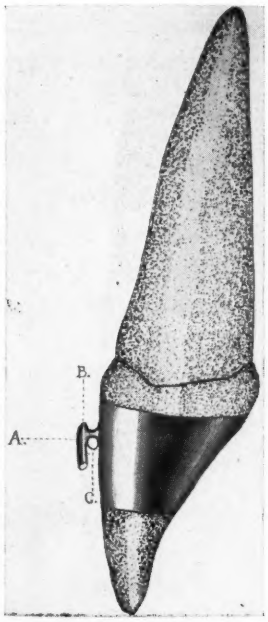

Fig. 20.—Case 4. Hook attachment for securing arch wire to teeth anterior to molar anchorage. *A*, Hook made from 0.030 spring wire through slightly flattening wire and then bending to desired form. *B*, Hump made by soldering a 0.022 wire end with very small amount of solder to angle of bend, then shaping to form a slight projection which leaves a depression on cervical side of hook for reception of wire ligature used in tying arch into place. *C*, Round arch wire of 0.030 diameter.

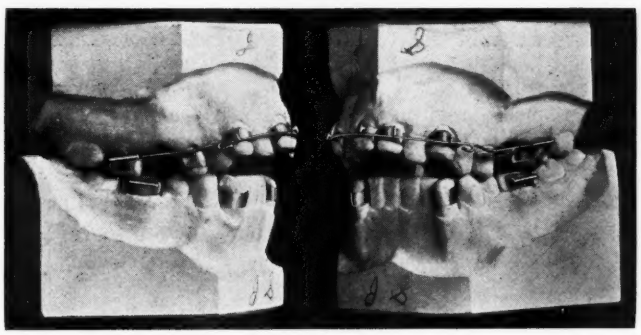

Fig. 21—Case 4. Shows the appliance used in the treatment of the maxillary teeth. Each maxillary incisor and canine band carried a hook attachment upon labial surface for the reception of the 0.030 arch wire, which is shown adjusted to lie at lower edge of hooks before springing up into hooks and ligating into place.

The maxillary premolars were moved posteriorly and the second and third molars forward to close the space occasioned through the extraction of the first permanent molars. At the same time buccal expansion of the maxillary arch was secured and the anterior teeth were moved downward into occlusion.

the rotated position of the molars, and also to allow the labial portion of the arch wire, before tying up into hooks, to lie at the lower edge of the incisor and canine band hooks, as shown by illustration. The anterior segment of the round arch wire was 0.030 diameter while the ends were 0.038 diameter and

fitted the tubes upon the molar bands closely. The arch ends were of uniform diameter throughout the length of the tubes and for a sufficient length in front of the tubes so that the molars could be moved forward.

The first effort in treatment was directed toward securing expansion of the maxillary arch and moving the second premolars backward, Fig. 22. The latter was accomplished through the medium of auxillary springs attached to the 0.030 arch wire. At the same time the maxillary second molars were moved forward to help close the space occasioned through the extraction of the first molars. As the premolars were moved distally and buccally, room was secured to move the canines downward and backward, at the same time the central incisors were moved downward through springing the arch upward and ligating into the hooks. When the central incisors had been moved down to a plane even with the lateral incisors, bands with hooks for attachment to the arch wire were placed on the latter. The arrangement worked very satisfactorily, in conjunction with the intermaxillary ligatures which were worn

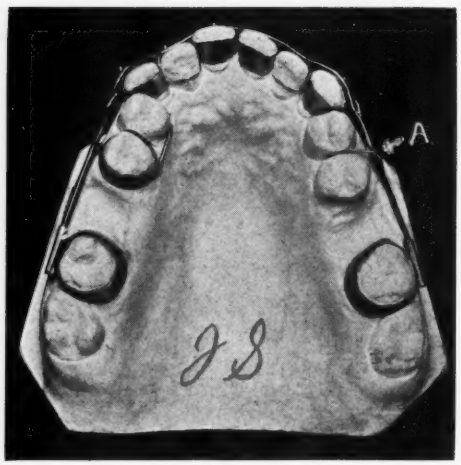

Fig. 22.

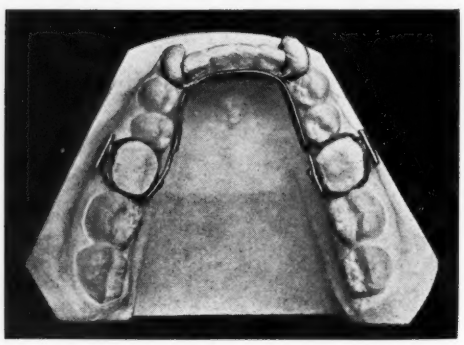

Fig. 23.

Fig. 22.—Case 4. Shows the spring (*A*) which was used to move the left maxillary second premolar distally, a similar spring was used upon the right side, but is not shown here.

Fig. 23.—Case 4. Lingual appliance as used upon the mandibular teeth for the first ten months of treatment.

from a hook soldered to the 0.030 arch wire at a point on each side opposite the canine premolar embrasure, down over the distal ends of the mandibular first molar anchorage band tubes. Expansion of the maxillary arch was accomplished, the anterior teeth moved downward, development of the bone followed, and the spaces occasioned through the extraction of the first permanent molars were closed.

Upon the mandibular teeth the lingual appliance[22] was used during the first ten months of treatment, Fig. 23. The first molars carried the anchorage bands. Buccal expansion in the premolar and canine region was secured, and the incisors, which were in lingual positions due to the pressure of the overdeveloped lower lip, were moved forward. After this period of treatment a plain labial arch was applied to facilitate rotation of the canines and to stabilize better the anchor teeth. The intermaxillary elastics assisted the forward

movement of the mandibular teeth. At the end of two years and three months the appliances were removed from the maxillary and mandibular teeth and Hawley retaining plates substituted; these were worn part time for one year and then all retention was discontinued.

Figs. 18 and 19 show a series of models of this case. Those in January, 1927, were made before appliances were constructed, the first before, and the second after the extraction of the maxillary first molars. Those of April, 1930, at the time all retention was discontinued show that the infraclusion and protrusion of the maxillary teeth have been overcome, also that the mandibular teeth have been brought forward. At this time the mandibular anterior teeth had the appearance of an "overtreated" case, in that they had a labial inclination. The models made in March, 1931, show that the teeth are settling into occlusal relations with but few signs of a relapse.

In October, 1930, the regular roentgenogram check-up of the teeth showed areas of disturbance at the root apices of the mandibular first molars, also that

Fig. 24.—Case 4. Profile photograph made in January, 1927, upon the left. The chin is shown to be retreating with abnormal muscle action causing a puckering of the tissues over the mandible. Profile photograph made in 1930, upon the right, shows the improvement in the face after orthodontic treatment, which included muscle exercises.

the alveolar crest was absorbed and involved the root bifurcation of the right first molar. The radiographic evidence also showed apical disturbance of the left maxillary lateral incisor; therefore, extraction of these three teeth was advised. The models made in March, 1931, Figs. 18 and 19, show that the maxillary second molars are beginning to lengthen and to rotate, though it is to be seen that rotation of these two teeth was not complete at the end of the active period of treatment. The mandibular second molars show a tendency to tip forward. The case should have a short period of retreatment and then the spaces should be retained by bridges.

The profile photograph made before treatment shows the chin to be retreating, Fig. 24. Abnormal muscle action caused a puckering of the tissues forming the chin. Our associate, Dr. Harry V. Banks, who later carried on the treatment of this case, instituted muscle exercises of the orbicularis oris and of the platysma myoides. There were two objects in view: first, to lengthen the upper lip; and second, to reduce the overdevelopment of the lower lip and

subjacent musculature. Our observation has been that in patients having a puckering of the chin the condition is due to an effort to compensate for the short upper lip by drawing the lower lip upward. Exercises were begun in March, 1928, and the puckering has disappeared. The photograph made after treatment shows the improvement in the features. The hump on the nose is the result of an accident.

I wish to emphasize the fact that it takes two or more years after all retaining appliances have been removed to determine if the treatment of a case may be classed as successful. This is especially true in open-bite cases, for following the period of active treatment and postoperative care there may still be abnormal pressure exerted by the abnormally developed tongue and lower lip, also lack of normal pressure from the upper lip. These faults may not have been entirely overcome, even though every effort has been made to train the patient in correct muscle function, and to overcome the habit of moistening the lower lip with saliva, which is so prevalent in dry climates. Therefore, I am not presenting this case as a finished result.

SUMMARY

1. A broad knowledge of growth, development, nutrition and of the requirements of a well-balanced diet is essential for a basis upon which to begin the study, or diagnosis, of the causes of malocclusions of the teeth.

2. It is necessary to have a complete diagnosis of the physical condition of the patient with the help of a competent physician in those cases where necessary; accurate models; intraoral and extraoral and profile roentgenograms of the teeth and face; photographs of the head and face from at least four positions; careful consideration of pressures from the tongue and also from external agencies; then an earnest effort should be made to correct predisposing and determining causes of the malocclusion. If the above have been accomplished even with a fair degree of success, the mechanical problems of moving the teeth into positions of normal occlusion are not insurmountable and depend in a large degree upon the good common sense, coupled with the technical skill of the operator. My observations have been that the incidence of radicular absorption of teeth in treated open-bite cases is no greater than in other types of malocclusion.

3. The postoperative period of treatment is as important a factor as the two foregoing, for the reason that some of the predisposing and determining causes of the malocclusion may still be present and the teeth will have a tendency to relapse toward their former positions. Therefore, the case must be watched carefully, the teeth retained in their correct relations through mechanical means, if necessary, until the time comes when, through the removal of part or all of the retaining devices, it is found that the teeth will remain in positions at least closely approximating the norm.

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DISCUSSION

Dr. W. E. Flesher.—When Doctor Ketcham gives us a paper, it is always a treat. He knows how to prepare a paper, his material is ample, and his presentation is logical and convincing. Not only is he always scientific, but he gives us something of a wide practical value. To have had the privilege to glean in a limited degree from his brilliant mind and his wide experience has been my good fortune.

Since Dr. Robison will discuss Dr. Ketcham's paper largely from the aspect of the influence of muscular function in development, and Dr. Leonard will discuss the treatment of certain types of apparent open-bite cases, I shall direct my limited remarks chiefly toward the effects of habits in the rôle of treatment.

Habit, as we all know, is a result of repetition. The performance of an act for the first time requires a certain amount of thought, a conscious effort. Each repetition of this act requires less and less of conscious effort until soon it requires none, when it can be said to be truly a habit. Much of our daily routine in our offices is done through habit. While doing certain duties we are thinking about other problems. We could accomplish little or

nothing if we had to think of each little act. We walk, we talk, we smile, we frown, we feed ourselves, we drive our cars through habit. All of these and many others have grown into our very being; they help to make us who we are; they control our personality. Habit is the plan through which life operates. It is a natural phenomenon of living protoplasm.

The following quotation from Dr. A. LeRoy Johnson is very clear: "The phenomenon of habit is a normal manifestation of living tissue essential to the development and functional activities of the organism. Normal habit movements help to maintain normal structural form. Abnormal habit movements are associated with abnormal structural form. Habit, then, an intrinsic organic force, like all natural processes, is a factor in adaptation which, if perverted in its action, will be as potent an influence in maladjustment and subsequent disorganization. A pernicious habit is an expression of a natural phenomenon gone wrong."

When we speak of habits as associated with malocclusion of the teeth, we are considering the bad or pernicious type. Abnormal habits and abnormal function, which go hand in hand, have a deterrent effect on growth and development.

Abnormal habits, in my opinion, have more effect in producing malposition of the teeth than we think. Certain types of open-bite cases are traceable to the influence of abnormal habits. The treatment of such cases should include a careful study of such habits as the child may have, and when diagnosed, we should take immediate steps toward correcting them. Many of these habits are so deeply seated that one's genius and diplomacy are taxed to the very limit in one's effort to secure their correction.

It is a childish instinct to suck and to chew. These are normal processes and care should be used in that they are not perverted through the acquiring of a pernicious habit. It is instinctive for an infant to carry everything in his hand to his mouth. Whether he sucks his finger, thumb, fist or clothing depends on which he gets hold of first, and the next thing he does is to suck. The time to correct such influence over growth and development as this habit may cause is a drastic procedure at the time the habit is being formed, preventive, of course. This habit may produce an open-bite, whether it is an infraversion of the incisors or a supraversion of the molars.

A child's instinct to chew should be encouraged at the proper time and that is about the time of the eruption of his teeth. Every effort should be exercised during this period to develop as far as is possible, a correct habit of chewing. He should have some food of the type that requires some masticatory effort. This aids in developing the dental arches laterally and providing space for the incisors to erupt more completely. This, of course, is also a preventive measure.

For a number of years I have been observing very closely the movements of the lips and tongue of patients as they sit in the chair and as they speak. I observe many peculiar and unnatural movements that one would not usually surmise. When there is a partial relapse after the treatment of an open-bite case, I usually find there is an abnormal movement of the tongue.

I shall briefly enumerate some of the habits which in my observation seem to have an influence in the treatment of open-bite cases.

In the bottle-fed cases through the abnormal suction force, when not overcome by other normal functional processes, we may expect a contraction of the dental arches. This condition will so interfere with the development of the anterior segment of the dental arches that the process of eruption will be unable to overcome the effect produced by the constricted arches. In these cases an expansion of the laterial halves of the arches will release the forces of growth anteriorly. In many cases the anterior teeth through the new impulse in growth will erupt into normal functional relationship.

At the time when the deciduous teeth begin to exfoliate, the child finds a new playground for his tongue. He finds much delight in making frequent excursions over this mouth with his tongue. He develops a new habit, that of thrusting his tongue through the newly found opening, or entrance into a new realm of pleasure and thrills. So persistent is he that development in that region does not take place as rapidly as in other parts of the dental mechanism. The anterior teeth are the first to be lost. Here is where the newly found joy asserts itself. The tongue may be thrust through the space frequently, or what

is worse, is permitted to rest in this opening when it is not in use. If the tongue is oversize, it will be certain to find this opening and to stay there.

Another point to consider is that when the tongue rests in the opening, the balance of pressure against the lateral halves of the dental arches is broken, thereby interfering with the normal growth in width of the arches. This would, also, be a contributing factor in producing a lack of development in the region of the anterior teeth, thus interfering with the process of eruption in addition to that of the pressure of the tongue itself.

The expansion of the dental arches and a correction of the tongue habit will be of material aid in treatment. The normal forces of growth will have been released.

We are all familiar with the habit of frequently moistening the lips with the tongue. This habit can be of such frequency as to interfere with growth in the anterior segment and with the eruption of the incisors.

An observation has been made in our office of a few cases in which at the conclusion of the act of swallowing the patient thrusts his tongue between the anterior teeth. This extrusive act of the tongue may have sufficient force to prevent the complete eruption of the incisors.

Biting or sucking the tongue or lips is another phase in the rôle of habits that react on the growth affecting the incisor regions.

As Doctor Ketcham suggests, proper nutrition and metabolism play an important part in the growth and development of an organism. A deficiency in either or both will have an abnormal effect. This may be of such extreme character as to produce rickets. Doctor Dewey in his *Practical Orthodontia* suggests that the mandible may be so deficient in the mineral elements that the muscle pull will tend to straighten out the mandible at or near the angle, in which event an open-bite is produced. In this condition with only a few teeth in occlusion in the posterior part of the mouth, the open-bite effect is further aggravated through the loss of function of the teeth in mastication. There is usually a crowded condition in the molar region, and through the effort of the third molars to erupt, the first and second molars seem to have elongated or crowded, out so to speak. This would be called supraversion of the molars, or as Doctor Howard suggests, hyperdysplasia, to be correct. I shall leave treatment problems of this type for Doctor Leonard to solve.

During my orthodontic experience, I have had some observations that have caused me some sadness, and modestly I might state some further experience in treatment. In fact, I have had some relapses in open-bite cases. This fact used to worry me considerably, but when I learned of the percentage of relapses other operators enjoyed (?) my depression was relieved.

I appreciate fully the deep study given the various phases of this subject by Doctor Hellman, Doctor Howard and Doctor Ketcham. Their work has helped us to understand this condition more fully. Doctor Ketcham has once more brought to the orthodontic profession through his fund of knowledge and experience some helpful and valuable information. We shall always be deeply indebted to him for this and other contributions.

Whatever other causes there may be for the open-bite condition, I am convinced that in practically every case, we must consider abnormal habits as having some influence. It is but natural such weapons as are necessary—the lips, tongue and fingers—are ever present and ready.

Whatever measures as are used in treatment of open-bite cases, we must be sure our diagnosis has eliminated pernicious habits, for if present they must be recognized and corrective measures instituted at once.

I attribute some of the relapses of our cases to the lack of cooperation on the part of the patient and the failure to correct the tongue and lip habits. To correct a habit is not an easy thing to do. It requires the full and persistent cooperation of every one interested in the case or individual.

Dr. A. W. Crosby.—My first wish, and it is an agreeable one, is to express my appreciation of the thoroughness and painstaking preparation of Dr. Ketcham's paper. This is characteristic of our essayist in everything he does.

One of the first cases I treated after I left the Angle School was that of a young girl about fourteen years of age. I showed the casts, photographs and the result of the

treatment to Dr. Angle, who said I was very fortunate in my results but advised me against undertaking pronounced open-bite cases until I had several years of experience in orthodontia. It seemed a plain case of "Fools rush in where ANGLES fear to tread."

When Dr. Ketcham sent me a copy of his paper, I decided to present two cases which I thought might augment the ideas he is calling to our attention.

There are different degrees of open-bite, and they occur in all classes of malocclusion. The incipient variety was well portrayed in the last paper Dr. Alfred P. Rogers read before this Society. One variety Dr. Cryer showed at a meeting of the Eastern Association of the Graduates of the Angle School of Orthodontia in New York a year or two before he died. This is one to which I shall call your attention. These patients are mouth-breathers. There are hypertrophied tonsils, and usually more or less adenoid hypertrophy in the nasopharynx, which forces the patient to breathe mainly through the mouth.

In this case the tongue lies on the floor of the mouth. The mandibular arch is well developed and the maxillary arch is constricted. More or less buckling occurs in the maxilla. The most noticeable thing outside the infraocclusion of the anterior teeth is the overeruption of the molars.

(Slides were shown.)

Such a case calls for the development of the maxillary arch, closing of the bite in front and depression of the molars.

Dr. Ketcham has graphically described in his paper the technical problems involved. Here we used the expansion arches with anchor clamp bands on the molars. The screw ends were allowed to rest against the second premolars on the upper and a finger soldered to the clamp band rested against the lingual of the second molar. Thus the expansive pressure of the arch in the round tubes allowed these teeth literally to roll out. They quite readily settled into a good cusp relationship with the mandibular teeth.

Spurs were soldered to the maxillary arch a little to the left of the center of each incisor to open the space for the maxillary right canine. The arch was bent down a little at a time to make the incisors which were ligated erupt to close the bite. Later a short spur with a ball end was soldered to each arch in the region of the canines, and small elastic bands were used to hasten the closing of the bite and to relieve strain on the molars.

This type of open-bite is usually free from tongue habit.

Dr. Hellman said in a recent paper that probably 50 per cent of the cases of open-bite which were treated were failures. He had in mind, I think, the large percentage of these cases in which the tongue habit prevails.

When some one asked Socrates if he were not discouraged because more of his pupils did not take up his teachings, he is said to have replied, "If one in 20 profit by my philosophy I feel that I am rewarded for my efforts."

There are, as all know, all degrees of cooperation from patients, from practically none to full and satisfactory teamwork. (Slides were shown.)

The next case is one in which the open-bite did not occur in the front of the mouth. It is one, too, in which the tongue, as far as I could detect, did not play an important part in the malocclusion. We had appliances on the deciduous teeth in an endeavor to close these spaces, the opening on the right was 7 mm. and on the left 3.5 mm. We used auxiliary springs to try to bring these teeth into occlusion. They moved very reluctantly and would not stay in occlusion. We tried again when the premolars erupted with no greater success. There did not seem to be the urge in the bone to grow.

Referring to the reluctance of the bone to develop in this area I would again (Dr. Ketcham has already done so) call attention to what investigators like Hellman, Todd and Brash have demonstrated, to wit, that the bones of the face have spurts of growth, that the development happens in different bones at different rates and in different parts of the same bone at different periods of growth.

Finally we thought we would see what function would do and employed Dr. Henry C. Ferris' "Odonto-Bell," with which you are probably all familiar, and in six months had the teeth in occlusion. Then we used the temporomasseter exercises as suggested by Dr. Alfred P. Rogers with the result you see on the screen. The relationship still continues to improve.

I have noticed that there are cases in which the unerupted third molars seem to cause the other molars to overerupt somewhat and open the bite. In my experience it has *not* been

good practice to employ the temporomasseter exercises where there is a definite impaction of the mandibular third molars.

(Slide was shown.)

Just a last word in reply to Dr. Ketcham's statement that rickets is probably the chief etiologic factor in open-bite cases. We must not forget that such specific causes as congenital syphilis and tuberculosis are sometimes to be reasoned with. I believe the endocrines have something to do with a type of malocclusion which I show in this illustration. This is an acromegalic type, and as Sir Arthur Keith said, "There are cases in which there may be an acromegalic taint when the deformity may be confined to one part only, as the lower jaw, a molar bone, an eyebrow ridge or to a finger."

Dr. Norris C. Leonard.—In dealing with open-bite I feel that orthodontia is facing one of its biggest and most difficult problems, and that the axiom of the essayist concerning the fundamental importance of diagnosis grounded in the broadest possible knowledge of etiology is particularly applicable in our consideration of treatment of this condition. We are able to recognize in connection with the development of open-bite, certain disturbances to normal growth that are still more or less obscure in origin, some of them possibly beyond our control. There are certain factors in the manifestations of this anomaly that are fairly constant in the clinical cases that present, and yet there are enough differences to justify a more definite classification in order to give a better approach in the consideration of treatment. I shall not attempt such a classification but merely mention some of the factors and conditions to be taken into account in this connection:

Tongue habits and thumb-sucking.
Adenoid type with underdeveloped mandible.
Mouth-breathing with constricted nares and subnormally developed maxillae.
Low tonicity of masticatory muscles—congenital or habitual.
Deformed mandible of the straight type—obtuse angles.
Acquired open-bite, as a result of mechanical stimulation in orthodontic treatment.

These are merely the more superficial and obvious factors that perhaps to a certain extent obscure the fundamental causes more directly responsible for the perverted growth. There is much work yet to be done in the study of the problems of etiology as well as problems of treatment. We are at least able to recognize conditions that are present, and should not feel justified in withholding efforts at their relief until all the problems of treatment have been solved.

The essayist has already shown us some excellent results in very exaggerated cases and should feel much satisfaction in these successes.

In view of previously published reports, I have been asked to discuss another phase of open-bite treatment that seems to have had little attention up to the present time, but which I am convinced should be considered seriously and favorably in this connection.

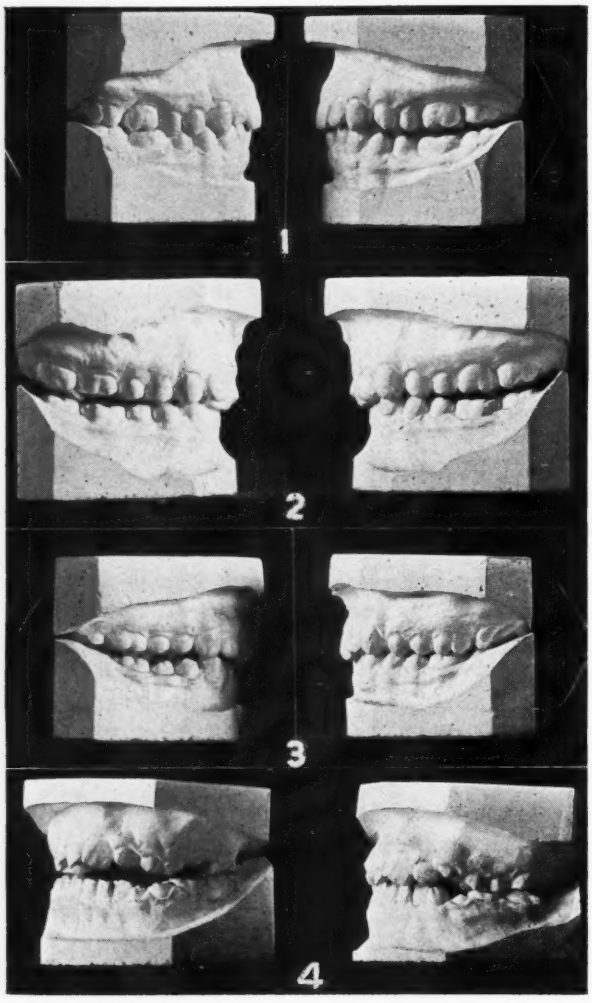
A careful study in the diagnosis of open-bite cases will reveal to the observer that a very large percentage of these malocclusions are in reality supraclusion of the buccal teeth rather than infraclusion of the anteriors; and that if a reduction of this elevated position of the molars and premolars could be accomplished the result would be much more harmonious than by bringing the anteriors to the occlusal plane of the molars.

With this in mind I wish to bring again to your attention a very definite principle that has a practical application in the reduction of these supraoccluded teeth, and which for this reason, promises to be a valuable aid in the treatment of open-bite.

The principle referred to may be demonstrated by cementing overlays to the grinding surfaces of normally occluded molars or premolars so that their contact with the opposing teeth in the opposite arch will raise the occlusal plane of these teeth slightly above that of the adjacent buccal teeth.

If these overlays are worn for a few weeks and then removed, it will be found that the teeth to which they were attached and those with which they came into functional contact in the opposing arch have been depressed, or driven deeper into their sockets, and are therefore out of occlusion. This occurs irrespective of the number of teeth included, or whether the overlays are applied unilaterally or bilaterally. This is due to the increased elastic tension and established contracting habits of the muscles.

This result was first observed in an effort to open the bite by cementing a series of crowns or attached overlays to the mandibular buccal teeth on one side of the arch only, in the belief that this would maintain the new occlusal plane until the buccal teeth on the opposite side of the arch came into occlusion and established it definitely. It was soon discovered, however, that the muscles could not be so easily tricked into new habits; and the teeth carrying the overlays and those with which they came into functional contact were depressed until occlusion was restored on the opposite side to practically the original plane. Later a similar device with a sliding occlusal plane for shifting the bite mesiodistally was developed and used successfully for this purpose in a series of some thirty cases. These were



Figs. 1 and 2.—Unilateral depression of molars and premolars from a device with sliding top attached to buccal teeth to correct unilateral distoclusion. These teeth came slowly into full occlusion after removal of appliance.

Fig. 3.—Case of bilateral distoclusion, showing depression of two molars and premolars from application of the sliding top device attached to the mandibular buccal teeth. Both sides depressed alike. Patient fifteen years old.

Fig. 4.—Case of open-bite of a girl about eight and one-half years of age, treated with overlay in the form of shell crowns on the two maxillary first permanent molars, the cusp portion being cast thick enough to increase the open-bite about two millimeters, and formed with occlusal portion adapted for functional contacts with the mandibular first permanent molars. Worn about eight months. No tendency to relapse shown after a six months' interval without appliances of any kind, and an additional six months of further treatment for corrections in incisal regions.

used in both unilateral and bilateral distoclusion cases, opening the bite, when inserted, from two to three millimeters and engaging from two to eight teeth. In every case of the series, whether the appliances were used unilaterally, or bilaterally, the teeth to which they

were attached and those with which the device came into functional occlusion were depressed to approximately the thickness of the appliance. This was accomplished without the slightest unpleasant symptoms; and after removal of the appliances the teeth without restraint came slowly into occlusion again just as in normal eruption. The constancy of results has been borne out in every similar test.

The fundamental truth which I wish to impress is that any constant and sustained increase of muscular stress beyond the normal physiologic balance, when functionally applied to the teeth in an axial direction, will to some degree change the relative position of the occlusal plane, either by forcing the teeth deeper into the alveoli, or by lifting them farther out.

I am bringing this to your attention as a practical principle to be used for the reduction of supraoccluded teeth in the treatment of open-bite.

While my preliminary use of this principle for the reduction of open-bite has not shown as definite results as has its use in the other types of cases mentioned, my experience so far has been very encouraging. The difference is apparently due to bone quality in its relation to muscular stresses.

A slide of my most recent open-bite case is now shown on the screen, and a brief report is as follows:

This patient, a girl, was first seen and models were made at the age of eight and a half years; health good, teeth in good condition, with both arches narrow, lower very slightly distal in occlusion, first permanent molars erupted but not yet in occlusion. Anteriors of both arches were well erupted though crowded and slightly rotated, with the maxillary incisors displaced mesially, and the mandibular incisors slightly tipped distally, leaving a considerable open space in the incisal region.

The patient when very young had ben a thumb-sucker, but this habit had been discontinued at the age of four years. No forward tongue habit could be elicited, though there was apparently a habit of holding the tongue very far distal, particularly when talking; fine development of nasal openings with no indication of mouth-breathing. At that time a definite indication to open-bite was noted and called to the attention of the parents.

Treatment: Both arches were slowly widened by means of lingual arches anchored to the second deciduous molars.

At the age of ten and a half years the permanent first molars had come into occlusion and were opening the bite still farther, leaving the deciduous molars out of occlusion.

At this time treatment for reducing the open-bite was begun. Bands fashioned like shell crowns were made for the supraoccluded maxillary first permanent molars, the occlusal portion being cast so as to increase the open-bite, when cemented in place, about two millimeters.

These bands, or crowns, were left in place for about eight months, during part of which time some slight adjustments were made to the incisors through the means of a labial arch attached to the molar bands.

When these crowns were removed, it was found that the open-bite condition had been reduced to the extent shown in the models. Impressions for these models were made after a six months' interval during which time no appliances were worn, and no tendency whatever has been shown to the present time, nine months later, toward a return to open-bite. At no time while the overlays were being worn was there the slightest discomfort or soreness. Adjustments of the incisors are now in process, using the formerly supraoccluded teeth for anchorage.

The age of the patient, of course, would seem to be a very important consideration in this treatment, though in the series of distoclusion cases reported the response was apparently as great at the age of nineteen years, with eight teeth carrying overlays, as in the younger cases with fewer teeth involved.

Early recognition of open-bite, however, and prompt treatment, would seem the most logical course.

The overlay construction may be worked out to accord with the technic of each individual operator. But after much thought and experimentation I have come to the con-

clusion that the most satisfactory results can be obtained by using as a basis the band technic of Dr. R. C. Willett of Peoria, Ill.

After the thin band or shell covering the buccal, occlusal and lingual surfaces has been cast from rather high-fusing gold, it then can be slipped onto the tooth and built up to the proper height with casting wax, allowing the impression of the opposing tooth to be fairly well defined in the occlusal. Before making a second casting to complete the overlay a large hole should be drilled on the buccal through the gold shell and wax at a favorable place to facilitate removal from the tooth after cementation. This hole may be stopped with gutta-percha through which a warmed tapering instrument may be forced and the overlay "wedged" off.

This form of overlay is preferred because it does not extend into the interproximal space and requires no separation. This is important since it is usually necessary to place the appliances on several adjacent teeth.

When these are properly "knuckled" together and cemented to place they are very easily cleansed and may be worn indefinitely without hazard to the patient, who need not be seen except at long intervals for observation. Of course before instituting this treatment for reducing the supraocclusion the teeth to be treated should be otherwise placed as nearly as possible in normal relations.

SUGGESTIONS FOR APPLIANCES AND THEIR DESIGNING

By Ernest N. Bach, A.B., D.D.S., Toledo, Ohio

SOME time ago Dr. Hoffman asked me if I would present at this meeting of the Chicago Dental Society a paper on some orthodontic subject. His surprising request took me rather unawares, as the presentation of a paper on the technical aspects of orthodontics was something yet to be experienced. All of us know that we owe a duty to our orthodontic and dental societies, and I feel that a person who has gained some experience, encountered and overcome difficulties in his practice, or discovered ways and means to take care of new situations which arise every day, not only should be willing (and I believe we all are) to pass this information on to his fellow practitioner, but I also believe it is his duty to do so. Some eight or ten years ago a club which is now international was formed within the membership of the Y.M.C.A. in Toledo, whose motto reads—"To acknowledge the duty which accompanies every right." So, after expressing these views on the matter, I not only consider it a great pleasure and privilege to be asked to present a paper at this meeting, but feel it my duty to pass on to others what little experience and information I may possess on the subject "Suggestions for Appliances and Their Designing."

At the outset, I wish openly to apologize to my discussors for not having a copy of this paper in their hands at an earlier date. As it was my impression there would be no prepared discussion, I had consequently delayed in the final writing, until informed to the contrary by your chairman a short time ago. And also, since the subject of this paper involves questions pertaining to both the labial and the lingual arches, I wish to offer still another apology to Dr. DeVries and Dr. Oliver for touching upon some phases of these appliances which they may cover.

There are numerous designs of appliances, but in reality there are basically but two kinds, namely, the labial and the lingual appliances. To be sure, there are variations in the design. For example, we have the Jackson appliance, a truly removable type; the removable lingual arch; and also the fixed or soldered lingual arch. To the plain labial and lingual appliances have been added any number of auxiliary attachments such as springs, bite planes, etc. Some operators find that certain attachments will produce their desired results, while others use a different means to obtain similar effects. Some prefer one type of appliance to the exclusion of the others, and vice versa. On the other hand, many men use a combination of both labial and lingual appliances. I find that most of my cases are treated with a combination of the two. It has been a rather routine procedure to use this combination with various auxiliary spring attachments as the case may call for. I

Read at the Midwinter Clinic of the Chicago Dental Society, January, 1930.

use a lingual arch because of its apparent effect of stabilizing the banded molar teeth. If no auxiliary attachments are needed, a soldered lingual arch is very often used, but a removable lingual wire is especially indicated where the spring attachments are desired. The reasons are obvious, i.e., additional springs may be added without removing the molar bands, more accurate adjustments can be made, and time is saved in repair.

This combination of appliances is especially preferred in cases with constricted arches and their resulting sequelae. The lingual arch and the auxiliary attachments serve their purpose well for stimulating lateral growth in the molar and premolar regions, and the labial arch for obtaining movements of the six anterior teeth.

There are a great number of designs in both labial and lingual appliances, and several of these will doubtless be shown and very ably discussed by Dr. DeVries and Dr. Oliver. I was requested to include in these remarks some of the ways and short cuts that are used in the office, together with some designs in appliances which may be worth consideration.

Indications for one appliance or another depend upon (1) diagnosis; (2) whether or not the appliance is to be used actively or passively; (3) mechanical requirements; (4) esthetics. Since we are not dealing with diagnosis, that important phase of the subject will be omitted.

APPLIANCE USED IN ACTIVE TREATMENT

We are assuming all through this paper that molar and other bands have been previously made by one method or another. I should like to state that our molar bands are either seamless or pinched joint, fitted directly, and all contouring with the exception of the occlusal edge is finished before the impression is taken. After the model is finished with the molar bands in position, the occlusal edge is contoured with a very small hammer and the interproximal edge is sometimes ground down with a stone, thus avoiding interference with the opposing tooth depending upon occlusion.

When any attachments are to be made to molar or other bands, the necessary amount of solder is flowed on the bands at the connecting point. This allows the operator to handle the blow pipe with one hand and the material to be soldered to the band with the other. We follow this procedure for practically all soldering to arches as well as bands, using 16 karat solder in wire form about 26-gauge. I believe Mr. Aderer advocates 14 karat solder for spring attachments, as there is likely to be less breakage than with the higher karat solders. Likewise, breakage may be due to two other causes. Quoting Mr. Aderer, "Unnecessary breakage of wires is due, first, to an excessive amount of solder, and second, to overheating the wire." He also advocates using solder cut up into very small pieces and placed in position by a camel's hair brush previously dipped in liquid flux. It would be very unhandy for some of us to go back to that method, as I find that wire solder drawn out to 26-gauge or smaller will allow the operator to use the smallest amount desired, and he can place it where he will and know it will remain there while heating the flux. I like S. S. White soldering flux in paste form. To insure making wire solder flow easier it is well heated and covered with

the soldering paste. The grease is burned off, leaving the flux to adhere to the solder. One never has oxidation of the solder taking place under these conditions.

When soldering any sort of tube to the bands, I always use a steel wire or needle, about the size and shape of the opening of the tube to be used. This wire is held in a wooden handle for convenience. (Fig. 1 *A*.) Gold solders appear to have very little affinity for steel, and when a needle or wire is dipped in Steele's antiflux paste it becomes more immune to gold solder.

For ease and flexibility in holding tubes while being soldered to molar bands we use the above mentioned steel needle or wire, the end of which has been shaped to fit the desired tubes depending upon the lingual lock we have decided to use. About $\frac{3}{32}''$ or $\frac{1}{8}''$ from the end, the needle is bent at right angles, and immediately bent again at about forty-five degrees. The object of shaping the needle this way will be more fully explained by the slide. A straight steel needle or wire is used for holding tubes while soldering to buc-

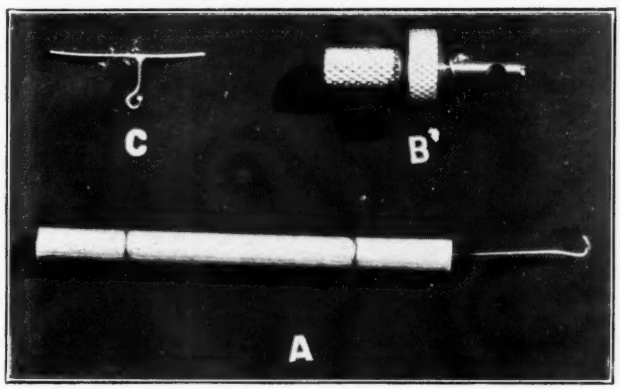


Fig. 1.—*A*, Shows a steel needle which had been inserted into an orangewood stick used to hold tubes while soldering to bands.
B, A solder trimmer. *C*, A hook which eliminates intermaxillary elastics from coming off.

cal or labial surfaces of bands. Tubes are often soldered more accurately by this means than when being held by tweezers.

While dealing with the operation of soldering tubes on molar bands for lingual arch attachments I am reminded of one particular difficulty which has annoyed me on numerous occasions. I refer to the soldering of the round or half-round pin to the arch wire. The difficulty has been the flowing of the solder onto the pin during the heating process. We all know the time and trouble involved in removing this excess solder so that the pin will not bind in the tube. I have found three procedures which have prevented most of the trouble. The first and most obvious is to use less solder (in fact just enough to make the wires unite firmly). In the second place, the end of the pin to be soldered may be slightly but rather bluntly beveled and the end filed flat. (Fig. 2 *B*.) Should there be any excess of solder it will fill in the space between the beveled end of the pin and the arch wire. And there is still a third way which has been very helpful. The pin is warmed in the flame, immediately pressed into Steele's antiflux paste and allowed to cool in

the paste so that this material will adhere to the pin. The pin is heated to a red heat to burn off the oils, then held in a pair of pliers while the end to be soldered is filed flat—not disturbing the sides or edges. Here we have the bright flat end ready for soldering to the arch wire attachment. I cannot recall when we have had solder flow onto the pin after using antiflux paste in this manner. Neither do I recall a broken, soldered pin joint.

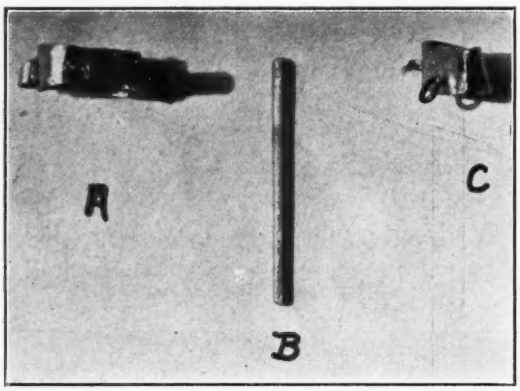


Fig. 2.—*A*, molar band with beveled lingual tube which aids in the insertion of the pin in the locking device.

B, Being hard to photograph, the upper end of the half-round wire does not clearly show the bevel spoken of in the description.

C, A wire spur made in the form of a loop which has been soldered to a band. It provides attachment for ligatures in any direction as well as being smooth for contact with tissues.

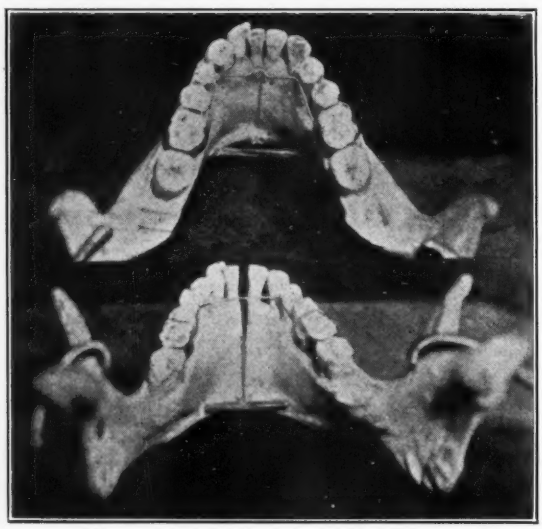


Fig. 3.—A lingual arch with anterior loops used for expansion. (Byington.)

I have had trouble with the arch wire breaking three or four millimeters anterior to the soldered joint. I have no suggestion to offer for this condition except that we use 14 karat solder at the union of the pin and arch wire, thus reducing the higher heat which would be necessary for 16 or 18 karat solders. Keeping the arch wire away, where possible, from undue strains exerted during mastication may also be an aid in preventing breakage.

Where a round pin and tube attachment is used and solder has flowed on the pin, the difficulty of removing this solder is very much simpler than on the half-round pin. A solder trimmer, designed for the particular gauge wire used, has proved the most efficient for this purpose. (Fig. 1 *B*.)

We are not overly particular to have "just enough" solder when attaching buccal tubes to the molar bands, because an excess of solder on the buccal surface will strengthen the band, and this extra strength is desirable at times when there is excessive strain on the buccal tubes during mastication.

Let us now consider a few points about the lingual arch which have given me considerable pleasure, and others which have not. The lingual arch and all other known appliances bear this one relation to orthodontics, namely, they are a means toward correcting malocclusion. The lingual arch is one of our best allies if used conservatively and with judgment. Many times, however, we have trouble resulting from excessive pressure being placed on auxiliary springs. They may be too long, or too many may be used on one arch wire with insufficient anchorage. For expansion we have better control of

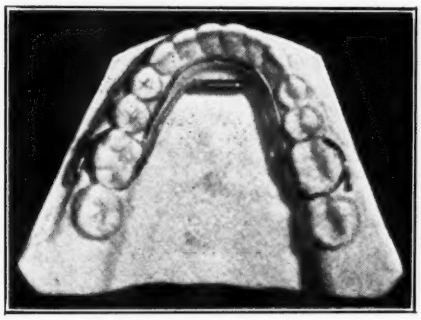


Fig. 4.—An appliance for expansion using the Barnes' Power Tube in place of the anterior section of the lingual arch. (Porter.)

lingual arches with spring attachments than when using arch wires with loops. (Fig. 3.) Lingual wires made with loops, or plain wire for wire-stretching adjustments, are easier to keep under control if they are made removable rather than soldered. It has been exceedingly interesting to note the variation in the position of the ends of a lingual arch after opening loops in the wire or adjusting with wire-stretching pliers. With either of the above designs where we believe the ends should be passive, the adjustment may result in an undesired spring in the wire in one direction or another. The removable wire gives the operator an opportunity to check on his adjustments, and the same holds true where loops on a lingual arch have been opened for expansion. An exceptionally experienced operator may make the adjustments very accurately and use a soldered lingual arch with safety, but I believe many of us are lacking in this technic.

There is another design of lingual appliance which Dr. Lourie Porter offered for your consideration some few years ago. (Fig. 4.) While it involves the principle of the once much used jackscrew, I believe it is less positive in its action and therefore a source of better biomechanical stimulation. In substance the appliance amounts to this. It is like a lingual removable arch

with plain lateral springs, the midway section of the arch being cut out and replaced with a Barnes' Power Tube. By unscrewing this tube it is believed expansion is better controlled for the average operator than by the loop appliance or wire-stretching technic. This design of appliance is mentioned here because of its proved effectiveness in my hands and is recommended for at least one thorough trial.

As nearly as I can determine from observing the results of various men, stimulation from auxiliary spring wire is the most desirable. However, producing spring pressure and controlling that same pressure are two different things.

Dr. Eby, some few years ago, advocated a more rigid wire for spring pressure. He made this assertion at a time when light auxiliary springs were being more widely used, and it seemed at the time of this statement that little movement would be obtained from a rigid spring. In many instances I am in accord with the use of stiffer springs. In the first place, adjustments are quite positive; and in the second place, they are not so easily displaced by forces during mastication as the lighter unprotected ones. On the other

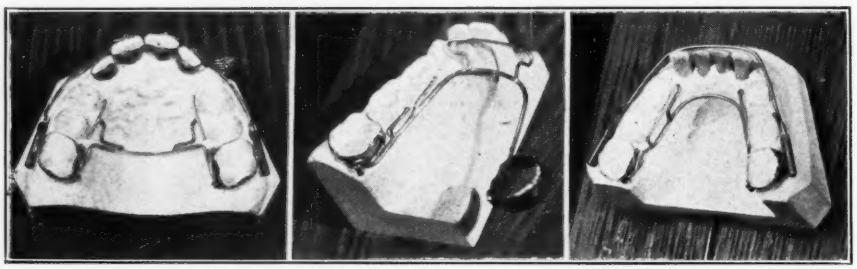


Fig. 5. Fig. 6. Fig. 7.

Fig. 5.—A high palatal arch using spring attachments for expansion in the premolar region.

Fig. 6.—This is a section of a model showing the lingual appliance with a lateral spring attached at right angles, one attached parallel, and a loop spring used for retaining anterior teeth.

Fig. 7.—Loop springs used for expansion

hand, a short light spring may surprise one by its effectiveness, and in many instances one has been used for each tooth between the first permanent molar and the lateral incisors for expansion purposes.

Springs may be (and very often are) designed to embrace three or four teeth, and it is obvious that one sufficiently long to engage this number of teeth would not control individual tooth movement as ideally as the individual spring. Surely one spring may very well be adapted for two teeth (Fig. 5), but the more teeth we attempt to control with one spring, the more difficulty will be encountered in adjustment and stability.

Lateral springs for expansion usually prove very effective. Trying to stimulate growth in the anterior region by the use of lingual spring pressure has not been so satisfactory in my hands as the use of the labial arch. Although various spring designs have been used for anterior teeth, well protected by short lugs soldered to the main wire, it is found that the springs slide on the lingual incline toward the incisal edge when the arch is dis-

placed away from the soft tissues by the tongue or other forces. Too great a pressure on these springs will also produce the crawling motion. Once these anterior springs have taken this new position and remained there for some time, we may expect a tipping of the incisors anteriorly, and the banded anchored teeth (usually the molar teeth) distally. A remedy which is suggested here would be to band some of the anterior teeth, and to solder lugs to the lingual surface of the band to engage the lingual arch or the free end of the springs. In this manner the whole appliance would be stabilized as well as the free end of the springs placed under better control.

In a number of instances I have had complaints from patients regarding the pinching of the tongue on appliances. Close examination revealed no sharp projections, no places where the moving of the appliance would produce a pinching effect, yet the condition persisted. It was found later that the lateral springs were lying in too close proximity to the arch wire, forming a V-shaped space of very small degree. This has been overcome by soldering all springs at right angles (or nearly so) to the arch wire, thereafter bending them to their desired positions. (Fig. 6.)

There is one other active spring which has been a source of pleasure to use in expansion cases and that is the loop spring. (Fig. 7.) This was de-

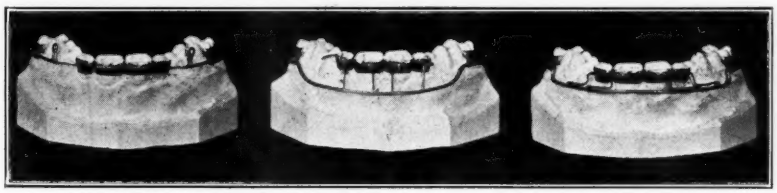


Fig. 8. Fig. 9. Fig. 10.

Fig. 8.—Shows an 0.020″ round wire used for aligning anterior teeth before attempting bodily movement.

Fig. 9.—A high labial arch with 0.020″ finger springs used for producing various movements of the banded teeth.

Fig. 10.—Spring attachments on the labial arch to which have been soldered short sections of a ribbon arch 0.020″ × 0.036″. These are used for individual tooth movements.

scribed in one of our journals a few years ago, and no more mention will be made of it here except to say that both ends being soldered to the lingual arch prevents distortion from forces exerted during mastication and can be controlled exceptionally well. A loop spring of this nature for retention does very well in the mandibular anterior region, provided the wire rests on the flattened lingual surface of the incisors and not at the gingival margin. (Fig. 6.)

There are a number of individual springs which may be soldered to the lingual arch for various needs.

LABIAL ARCH DESIGN

Here I wish to suggest only one or two methods which I like in producing root movement of the anterior teeth.

The teeth to be moved bodily are first banded with Angle bracket bands. These teeth are brought into their approximate incisal alignment by the use of an 0.020″ round wire, the late Dr. Hawley's method. (Fig. 8.) After this

incisal alignment is obtained, the 0.020″ wire is replaced by a high labial arch of 18- or 19-gauge to which are soldered long 0.020″ round wire finger springs. These springs nearly parallel the median long axis of the tooth, extending to the bracket on the band where they are bent at right angles, passing through the bracket and again bent at right angles toward the incisal edge of the tooth. By bending the wires in the desired direction any movement of the tooth with the exception of a lingual movement of the apices may be obtained. (Fig. 9.)

I also favor another method of obtaining apical movement of anterior teeth after the incisal edges are in approximate alignment. This procedure involves a labial arch of 18- or 19-gauge round wire which lies a few millimeters rootwise from the cervical margin. Round spring wires 0.020″ are soldered to the labial arch, eight to ten millimeters distal to the tooth to which pressure is to be applied. This spring lies in close proximity to the labial arch, extending to the desired tooth where it is bent incisally at right angles and cut off even with the bracket on the band. The end is then soldered to a piece of flat wire 0.020″ by 0.036″ which is lying in the bracket portion of the

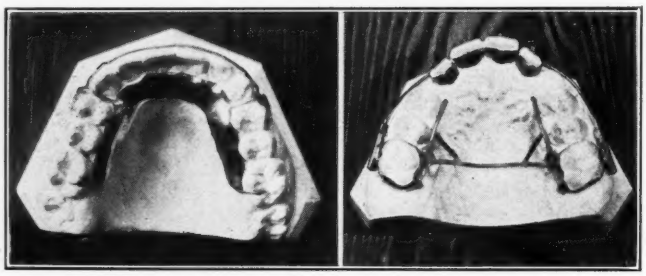


Fig. 11. Fig. 12.

Fig. 11.—A cast gold retainer patterned after the late Dr. Hawley's vulcanite retainer.
Fig. 12.—Nineteen-gauge wires originally used for expansion, now used for retainers, being made more rigid by the connecting wire soldered from the main wire to the spring.

band. The flat wire extends only a millimeter or so beyond the bracket. All apical movements of these banded teeth are thus possible and the small spring wire is used to produce the gentle pressure. (Fig. 10.)

RETAINING APPLIANCE USED IN PASSIVE TREATMENT

Here again the question of diagnosis, together with the original tooth position and jaw relationship, habits, etc., plays the important part in determining the kind of retaining appliance to be used. As was mentioned before, there are two kinds of working appliances; so likewise there are two kinds of retaining appliances, i.e., the fixed and the removable appliance.

Where conditions permit I prefer the cast gold appliance similar in design to the Hawley vulcanite retainer. This removable retainer provides in a measure for a freedom of movement and adjustment of teeth in the same jaw as well as in the opposing jaws. (Fig. 11.)

For a lingual appliance used to retain expansion I like the one shown in Fig. 12. In this type the bands are cemented to the molar teeth, and a removable, high palatal, lingual arch of 19-gauge wire is used. Lateral wires

of 19- or 20-gauge wire are soldered to the lingual arch and rest along the gingival margin of the canine and premolar teeth. These are made more rigid by soldering a 20-gauge wire from the main arch to the lateral wire, which arrangement also leaves most of the anterior surface of the palate free for tongue movement. The most inconspicuous labial wire design conducive to desired results should be used for the retention of anterior teeth. You are referred to literature on "The High Labial Arch" by Dr. Lloyd Lourie, of Chicago, for more details in the construction of this appliance. I believe he used the high labial arch for active as well as for passive treatment.

During the writing of this paper a few procedures of minor importance have been called to mind. Oftentimes when intermaxillary elastics are used, they become unfastened from the hooks when the teeth are in occlusion. This can be greatly overcome by making a loop on the end of a 20-gauge wire which extends nearly to the line of occlusion. The end of this loop is heated

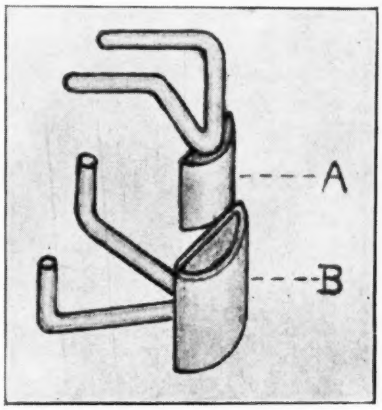


Fig. 13.

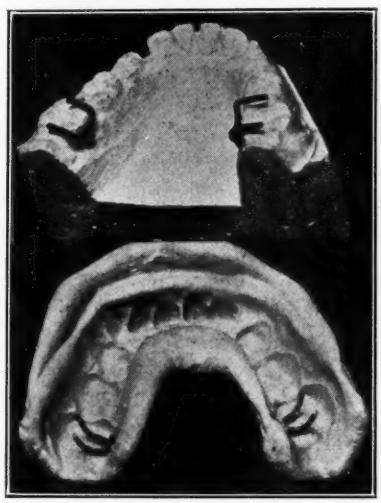


Fig. 14.

Fig. 13.—A drawing of a pin and tube to which have been soldered lugs. They are used for repairing lingual arches without removing molar bands. (Pullen.)

Fig. 14.—Model and impression illustrating use of pin and tube shown in Fig. 13. (Pullen.)

until a ball is formed. The wire is then bent until the loop is nearly closed, which necessitates the elastics being very thinly stretched to engage the hook. These very seldom come off. (Fig. 1 *C*.)

Whenever any lugs or spurs are soldered to bands and wires where it is desired to attach ligatures or engage elastics or springs, they are made in the form of a loop (from 21g or 23g, depending upon their use), soldering both free ends to the desired material. The loop allows the attachment of the ligatures in all directions and is less irritable to the tongue and lips. (Fig. 3 *C*.)

To overcome a little difficulty which we sometimes have when inserting lingual arches into the tubes on the molar bands, we bevel rather bluntly the occlusolingual edge of the tube so that while the pin portion is being pushed into the tube the locking spring wire is sliding over the edge of the tube

toward the gingiva without being distorted, where it eventually snaps into locking position. (Fig. 3 *A*.) A drop of Nujol on these parts will greatly aid in removing the pin later on.

Dr. Herbert Pullen, of Buffalo, has described a method of repairing broken lingual arches without removing molar anchor bands. These are shown in Figs. 13 and 14, and will be discussed in detail with the slides.

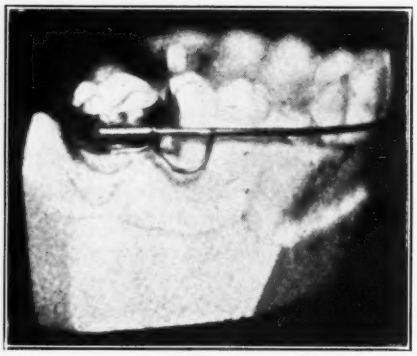


Fig. 15.

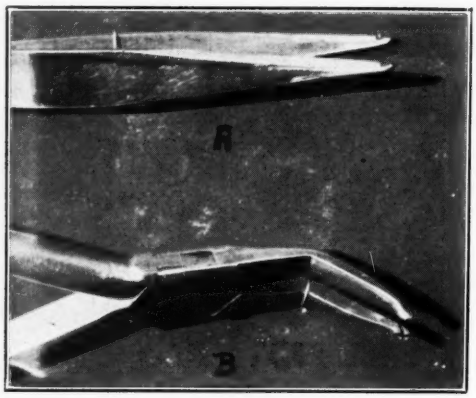


Fig. 16.

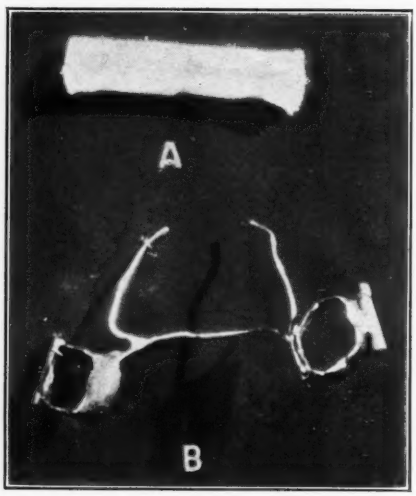


Fig. 17.

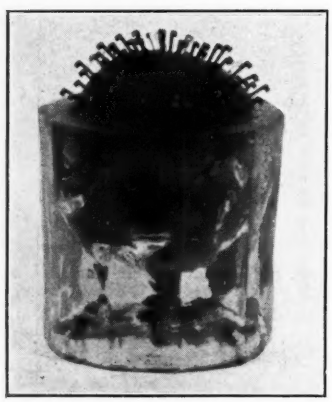


Fig. 18.

Fig. 15.—Shows a labial arch lock and spring. (Arnold.)

Fig. 16.—*A*, Soldering tweezer notched near the end with a file to aid in adapting a labial and lingual arch by heat.

B, Pliers with grooves in beaks. One groove is parallel and the other at right angles to the handles, providing a better grip for holding round wires.

Fig. 17.—*A*, Cotton roll, covered with gauze, helps to prevent cotton from catching under bands while cementing bands to teeth.

B, The lingual lock on the left molar bands covered with wax. This prevents cement from entering between the wires on the lock.

Fig. 18.—A "pincushion" of lock pins for Angle bracket bands.

A practical spring lock for labial arches by Dr. E. B. Arnold of Houston, Texas, which is illustrated in Fig. 15 is used advantageously for exerting pressure anteriorly as well as for retaining the labial arch in the buccal tubes.

I find the S. S. White Howe curved plier with smooth beak, No. 111, a

very good plier when handling wires. (Fig. 16 *B.*) To prevent wires from slipping when held by the pliers two grooves are ground into each beak, one at right angles and the other parallel to the handles. The grooves are made with a steel drill a little smaller than the wire for which the pliers are intended to be used. Likewise, one pair of soldering tweezers is notched on the side near the points to aid in adapting labial and lingual arches when bent by heat. (Fig. 16 *A.*) A slate pencil also aids in holding lingual arches while being adapted by heat.

Before appliances are placed in the mouth and cemented, it is customary to cover completely all the lingual lock and all the small connecting wires with soft pink wax, such as is used by supply houses for mounting artificial teeth. This prevents cement from entering the small spaces between the wires and obviates the necessity of removing the cement after it has set. (Fig. 17 *B.*)

I have followed a suggestion which Dr. Porter left with me a few years ago, of covering cotton rolls with gauze and using them to keep the teeth dry when cementing appliances. One does not have fine shreds of cotton being pinched and cemented under the bands following this method. (Fig. 17 *A.*)

Still another illustration of a simple means of saving time is shown in Fig. 18. It applies principally to men who are using Angle bracket bands. The illustration is a dappan dish convexly filled with the pink wax of which we have just spoken. This is used to hold the lock pins for the bracket bands. The pins are cut to the desired length and placed in the wax with all the heads pointing to the outer edge of the dish. The reason is this. As the operator holds the dish before him and with his pliers takes a pin from the right side of the dish, this pin is ready for insertion in the maxillary bands without manipulating the pin in any respect. If with his pliers he removes a pin from the left side of the dish, the pin is in immediate position for insertion into the mandibular bands. Since the pins were cut the desired length before placed in the wax, no further cutting is necessary after inserting the pin, and it can be immediately bent over with the same pliers.

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DISCUSSION

Dr. L. B. Higley, Iowa City, Iowa.—I wish, first, to thank Dr. Bach for his paper, which has been so ably compiled and presented. If his method of practice corresponds to the wealth of material and orderly arrangement of his paper, I am sure the community which he serves is getting only the best our art has to offer.

It is my sincere hope that all of you here have endeavored to construct an appliance of your own design or to work out a technic from your own experience, or will at some time

do so. In so doing you may better realize the numerous pitfalls one must evade in order to produce a working mechanism, or to present a simple and usable technic, in both of which Dr. Bach has shown himself to excel. All such work is a worthy effort in the advancement of our science, yet one must, in a discussion of a paper of this type, be discriminate in his approval or disapproval for the following reasons:

1. A given technic or appliance may be a panacea in the hands of the inventor, but be of only minor value to one not so skilled in its use.

2. The technic or appliance may be too intricate for ordinary procedure or use, even though it gives a gratifying result.

How prone we are to pass over others' ideas lightly, while we pat ourselves on the back for our own pet schemes and inventions; and so I hope that in taking up the various points in Dr. Bach's paper, if I should add to or detract from his original ideas, you will understand that it is in all sincerity to the profession and not any reflection upon the essayist.

I was especially pleased to note that Dr. Bach uses a combination of both lingual and labial appliances. Personally, I have no sympathy with those in the practice of our profession who limit themselves, in an already too limited field, by the use of one type of appliance to the exclusion of the other. It is certainly no exacting demand that we be familiar with both the labial and the lingual appliances and use the one best suited as indicated in the four points brought out by Dr. Bach.

In order to have a permanent cast upon which to make repairs or new parts, I use an indirect method of molar band procedure rather than the direct, unless the case is very simple or I am pressed for time. The bands are prepared over a metal model of the tooth, which has been incorporated in the cast of the arch, and the appliance is made to conform to this cast after soldering to the molar bands such attachments as are necessary.

The use of wire solder has likewise become a routine practice with me, except where quite a bulk of solder is necessary, in which case portions from the ribbon form are used. Not only in the soldering of buccal tubes to molar bands do I use an excess of solder but in any case where stability is required and where the additional amount will not cause a subsequent loss of function, as in the attachment of auxiliary springs. The use of the steel wire or needle in soldering tubes to bands is to be commended and the three procedures to reduce the binding of the half-round pin when soldered to a lingual arch may well be employed by us all.

I, too, prefer spring attachments rather than loops or plain wire for wire-stretching adjustments and also feel that the soldered lingual arch should be used in very few cases, because of difficulty not only in adjusting for treatment but also in repairing when distorted by the patient. In fact, I have eliminated this type entirely except as a form of retainer.

The Barnes' Power Tube can be used to advantage when a jackscrew, as formerly employed, could not, because in using the tube, the distance from the points of attachment of the main arch wire to the anchor molar bands allows the force to be more evenly distributed.

Regarding auxiliary springs, their attachment to the arch wire, adaptation, gauge, etc., much could be said. I certainly agree with the essayist when he says, "However, producing spring pressure and controlling that same pressure are two different things." Here as in no other place, one must understand thoroughly the mechanical principles involved and remember the physical law that to every action there is an equal and opposite reaction. Dr. Bach's finger springs seem efficient, but I have always preferred a spring which lies gingivally to the lingual arch. In my own practice I have overcome the crawling effect of the spring in moving anteriors by using a continuous resilient spring and by avoiding too much pressure.

This spring that I use is 0.022" and contains provision for lengthening. In contrast to the free end spring, it is soldered at both ends to the lingual arch wire in the region just anterior to the anchor molar bands and lies gingivally to the arch wire. Although I am not personally familiar with the use of the loop springs, they seem interesting and efficient.

While gaining expansion with a lingual wire, we obtain incisal alignment as described by Dr. Bach, only that we vary the Hawley method by using 0.020″ round wire in the incisor brackets only, thus eliminating the remainder of the labial appliance as previously shown in the slide.

The use of the high labial arch wire and finger spring for individual tooth movement is interesting, but, since the incisal alignment has been approximately obtained, I wonder if applying torque force for root movement would be more efficient with the spring method, but unequal pressure on the springs might cause an uneven alignment.

When a removable retainer is used, we prefer the cast gold as designed by the essayist rather than the vulcanite palatal portion. We have, however, obtained such poor cooperation from the patient in the use of the removable retainer that we use an all metal Hawley, substituting for the vulcanite portion, a lingual arch wire to which the anterior portion of the Hawley is soldered. This wire may be adapted according to Dr. Herbert Pullen's method for repairing a broken lingual arch wire, as has already been described. Molar bands are cemented to place, and the arch wire is retained by means of a tie lingual lock rather than a spring lock.

Although we may use Dr. Pullen's method in this connection, I do not see much advantage in such an indirect procedure for repairing a broken lingual arch wire where active treatment is in progress. There remain many ideas in Dr. Bach's paper which are so obviously helpful that I shall refrain from mentioning them.

Dr. G. Hewett Williams, Chicago, Ill.—Dr. Bach has so ably presented his material that there is little to be added by a discussion of his subject. His suggestions for appliances and their designing have proved quite useful to many, and I believe where indicated will fulfill all the requirements of efficient orthodontic mechanisms.

It is obvious to all that a fixed lingual appliance has many limitations, yet when used only for stabilization of the banded molar teeth, it has certain advantages not possessed by the removable lingual arch. The elimination of the half-round tube and wire, and lock wire give added comfort to the patient, also there is less danger of breakage and the appliance is much easier to keep clean.

Dr. Bach has referred to the frequent breaking of the removable lingual arch wire anterior to the half-round wire soldered joint. I have found that when the lock wire is soldered anterior to this joint, there is less danger of breakage. The lock wire in this position receives and modifies the stress which ordinarily is received by the body wire at the half-round wire soldered joint.

I heartily agree with Dr. Bach in his contention that it is better practice for the majority of us to use a removable type of lingual arch, especially when the requirements of treatment demand frequent changes in the outline of the body wire either by the use of wire-stretching pliers or by the formation of loops in the body wire.

The essayist has given many illustrations showing simple means of saving time in an orthodontic practice; some of these may seem of little importance to the novice; but to those of us who have had the sad experience of finding a tube full of cement or cotton shreds cemented under the gingival margin of a band, the importance of Dr. Bach's suggestions cannot be overemphasized.

A STUDY OF THE STRUCTURES OF THE FACE IN A CASE OF ANKYLOSIS BEFORE AND AFTER TREATMENT*

By Jos. D. Eby, D.D.S., New York, N. Y.

IN PRESENTING this case, I do not care to have you interested in any of its spectacular effects. While it does not and scarcely could bring out anything new, I believe that there are several very interesting analogies which may be compared with points of vital interest in the science and practice of orthodontia. At least it makes an interesting study in many vital factors involving the face.

It falls to the lot of every orthodontist sooner or later to encounter these cases of ankylosis. They are usually caused by some infectious process generally associated with dentoalveolar infections of deciduous molars, most

Fig. 1. Fig. 2. Fig. 3.

frequently unilateral, and occurring in infancy usually between the ages of three and five years. The degree to which they create deformity is proportionate with the time before interference is attempted and the extent to which growth has been retarded. Inasmuch as they are a radical condition, they have to be dealt with equally so, and due to hesitancy, conservatism or improper treatment, modified results or failures are frequent. Treatment in these cases is essentially the combined work of the surgeon, the prosthodontist and the orthodontist, in which cooperation means a keen appreciation by all of the value of the part to be played by each one.

This patient, aged twenty-three at the time of her operation, sustained an infection at the age of three years which resulted in a complete osseous infiltration of the left temporomandibular joint. Figs. 1, 2, and 3 are from photographs made at the time when a study of her case was begun. For twenty years she had never opened her mouth as much as one millimeter.

*Presented before the New York Society of Orthodontists, March 11, 1931.

One of the first points of interest was her good general physical condition. It is safe to assume that she had a strong physical background.

The next point which caught my interest was the fact that she had gone through the loss of her deciduous dentition and acquired her permanent teeth in a manner which is difficult to appreciate just how these events occurred. Many of her permanent teeth were eroded and infected, but the majority of them were in quite perfect condition. The next point of interest which touches close to our field is the amount of development in the mandible under conditions of total disuse for this length of time. We may assume that from the inherent will to grow about one-half the mandible formed, which leaves us to believe that the remaining portion in a normally developed

Fig. 4.

mandible is produced by function. From this I ask you a question which you must decide for yourselves, What are we to do concerning those domestic habits wherein the feeding of children leaves so little to mastication as to produce the deep overbites, posterior occlusions and other signs of underdevelopment of the mandible which are so prevalent in the mouths of infants today?

Fig. 4 is a profile radiograph which shows the absence of the symphysis, and the anterior development of the superior maxilla, with protruding maxillary incisors. Fig. 5 is from a specimen of a skull in the museum of the Harvard Dental School, which was presented to me by the teachers in the orthodontic department, and I take the privilege of showing it through their courtesy. This skull presents the clinical picture as it was seen during the

operation more accurately than radiographs or sketches could do. There was a complete obliteration of all anatomical landmarks anterior to the auditory meatus, the zygomatic fossa was invaded with bone, and the coronoid process was also fused to the zygoma.

The operation was performed by Dr. George H. Semken under rectal anesthesia administered by Dr. Jas. T. Gwathmey, and was so timed that the patient awoke peaceably within a few minutes after the operation was completed. The interesting phase of rectal anesthesia for oral and facial operations is the quiet respiration of the patient. The operation was performed through a small curved incision of minimum length to permit of retraction of the overlying tissues, avoiding interference with the fifth and seventh cranial nerves and the parotid gland. The cutting was done

Fig. 5.

with a series of straight-edged and angular chisels, tapering from both surfaces to very sharp edges. The first step was to sever the ramus about midway between the region of the sigmoid notch and the inferior border.

Following this there was a complete excavation of all of the bone above the line of the first severance. This was done with chisels and biting instruments, and the final bit of bone cutting in the upper region was to excavate an area which was to correspond with the temporal fossa. In the stump end of the mandible a V-shaped groove was cut for the purpose of gaining a secure mechanical attachment for the bone graft. At this juncture it became necessary to open the patient's mouth, which was found to be sufficiently responsive to require no gags or other instruments, but was gradually opened to the desired extent by digital manipulation.

When the mouth was partially opened, I placed my fingers in against the lingual surfaces of the maxillary and mandibular incisors, and to my sur-

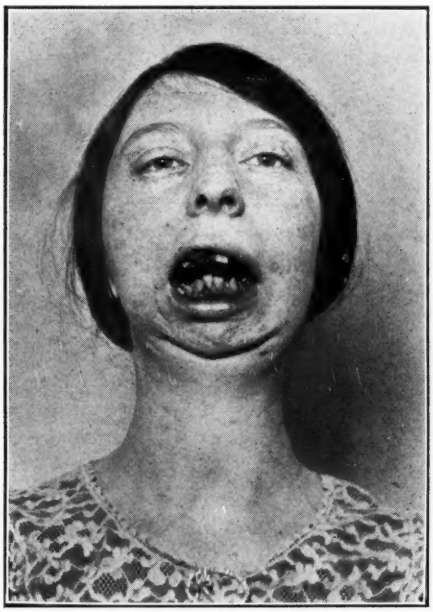


Fig. 6.

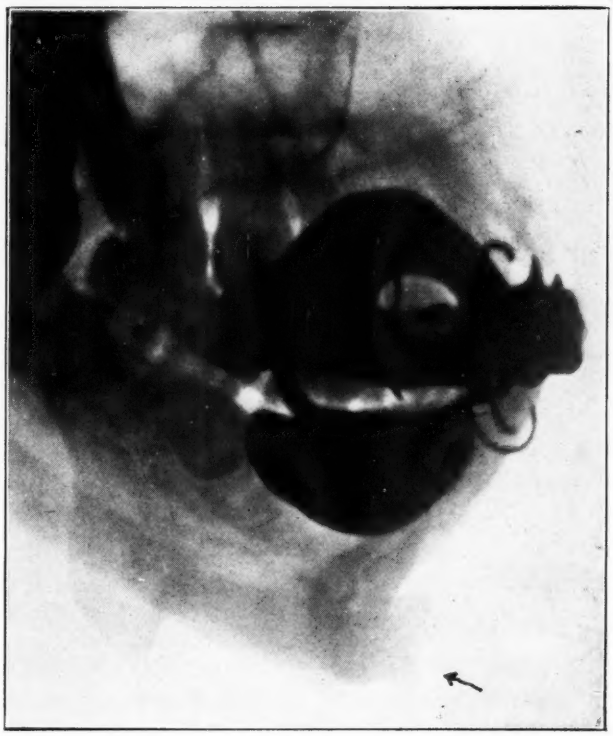


Fig. 7.

prise they all yielded. The four mandibular incisors fell forward out of their sockets and assumed positions almost at right angles to their correct positions. These teeth were manipulated back into place and the process was thoroughly compressed around, after which the teeth were left alone. This brings out another point of orthodontic interest in an extreme manner, showing the effect in the bone surrounding teeth which never had to meet any local demands of stress and strain. Today these teeth are all vital and

Fig. 8. Fig. 9. Fig. 10.

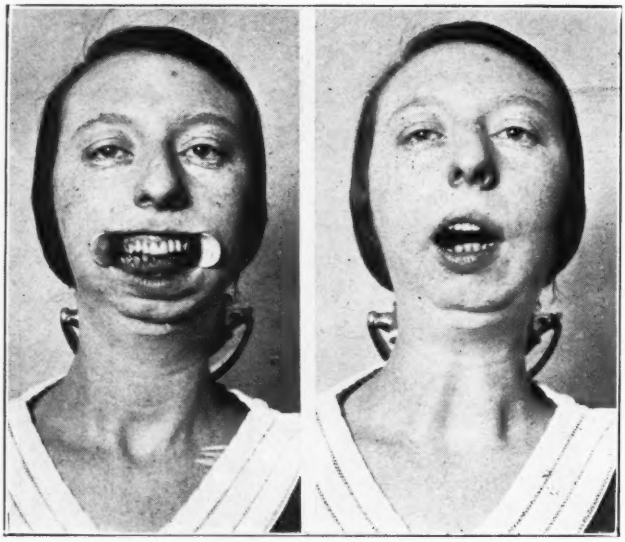


Fig. 11. Fig. 12.

as firm and secure in strong sockets and healthy tissue as if they had always existed under the most favorable conditions.

With the mouth open about 17 mm., rubber blocks were adjusted and ligated to the posterior teeth, and they remained in position for quite a length of time. With the mouth this wide open the length of the area between the fossa and the stump of the mandible was increased. Dr. Semken procured a piece of fascia from a thigh muscle and placed the raw surface against the artificially made fossa so as to effect a periosteal covering. The next step

was to procure a piece of fat to approximate against the fascia to serve as an intermedium against solidification of the bone graft and to aid in establishing a tissue lining for the joint. He then procured a graft from the anterior superior spine of the crest of the ilium which similated a curve suitable to that region of the ramus. This was cut into the form of a wedge to fit into the groove in the stump of the ramus and was trimmed to the form of a round head for the condyle at the opposite end.

Another interesting fact to the orthodontist is that Dr. Semken deliberately overcorrected the mandible in the length of the graft. As form is ultimately established by function, the increased muscle tension against the graft caused sufficient reformation within it so that the bone yielded until muscle pressure was equalized. If the graft had fitted perfectly in the beginning, any absorption would have produced a unilateral condition.

Another interesting point which pertains to the vitality of the face is the fact that this graft has but one united end. Fig. 6 shows the patient with her mouth partially opened some time after the rubber blocks were removed. Continued exercise gradually increased the amount and freedom with which she could open her mouth. At a subsequent date, approximately two years after the operation, Dr. Semken made an incision in the shadow line beneath the chin and inserted another graft to the point of the symphysis, also made of bone from the crest of the ilium, Fig. 7.

Figs. 8, 9, and 10 are photographs taken about a year after this operation and some three years after the first one. As soon as her mouth was readily accessible, all eroded and infected teeth were removed, and on account of the fact that orthodontic correction was impossible the protruding maxillary incisors were extracted. At this stage Dr. Edward Kennedy procured models of her mouth, and with the aid of a face-bow bite they were mounted on an anatomical instrument for the purpose of obtaining a corrected plane of occlusion which would lengthen her face as much as possible, as well as for establishing a good position of the mandible for function. Partial dentures were made supplying the missing teeth, using circular bent wire clasps and cusps cast to fit over the remaining posterior teeth in the effect of overlays up to the corrected occlusal plane. Fig. 11 gives some idea of the general esthetic effect of the teeth, Fig. 12 the same effect with the mouth open.

TWO DISTOCLUSION CASES

By Jos. E. Johnson, D.D.S., Louisville, Ky.

CASE 1. Bilateral distoclusion with linguoversion of the maxillary incisors, complicated with the extreme unilateral linguoversion of the mandibular molars and premolars. The patient was a boy, fifteen years of age. His history is rather uninteresting. His tonsils and adenoids had been removed when he was seven years old, and he had had all the usual childhood diseases, but none of them were particularly serious. His mother noticed nothing wrong until the deciduous teeth were being lost.

When the patient was about eight years old, the family dentist was asked about the teeth, and he said they were a little crooked but would stranghten out themselves. When the boy was fifteen years old, the dentist decided the teeth were not going to correct themselves, and he referred the patient to me.

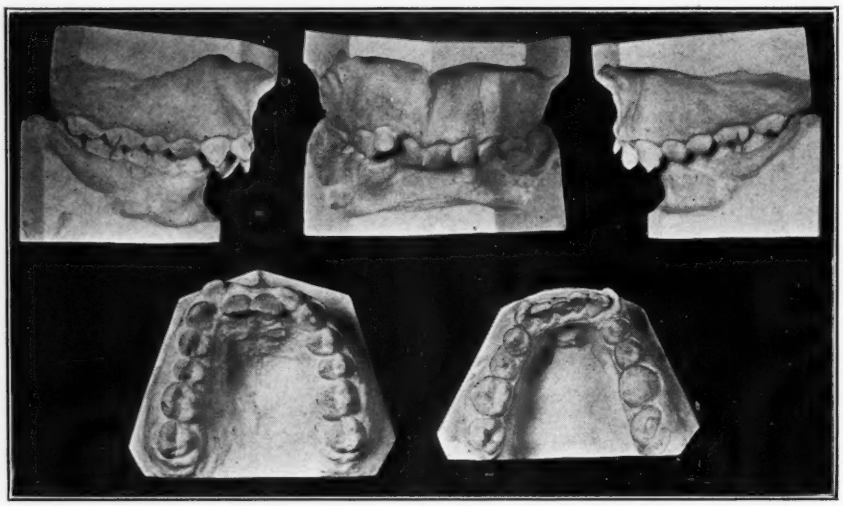


Fig. 1.

Fig. 1 shows the condition at that time; a bilateral distoclusion with linguoversion of the mandibular molars and premolars of the left side. The soft tissues were very spongy and congested; there was about the usual amount of decay, with a large, poorly placed, amalgam filling in the mandibular right first molar. Before making an impression, I instructed the patient to get a good toothbrush and showed him how to brush his teeth. I also had his teeth gone over for cavities.

As to the etiology, I believe the boy was born with the malocclusion. I believe he had a distoclusion with a linguoversion of all the teeth on the left

Read at the Thirtieth Annual Meeting of the American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

side in the deciduous teeth, and as he grew older, the condition gradually grew worse until it had grown into the malocclusion as shown in Fig. 1. As evidence supporting this theory, the boy had never been a mouth breather. His photographs, which I shall show later, present a normal condition except for a receding chin. I was never able to discover any bad habits, such as pillowing, posture habits, thumb-sucking, etc.

Fig. 2 is a study model of the case about eight months after treatment was started. It shows most of the appliances that were used. A bite plane is on the maxillary model; this was placed in position when the treatment was be-

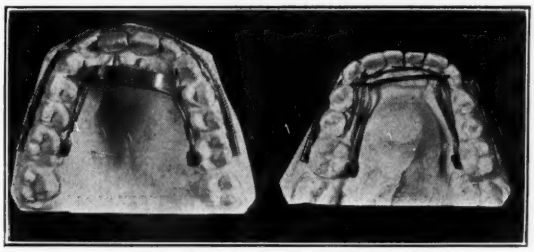


Fig. 2.

Fig. 3.

gun, because it was necessary to open the bite before I could move the left mandibular teeth, which were locked lingually. The bite plane also caused the mandible to slide forward. The maxillary central incisors were moved forward with a plain 18-gauge arch bar and 29-gauge buccal coil springs.

A lingual appliance was placed in the mandibular arch. On the left side the bar stood away from the premolars, while on the right side it rested against them and a finger spring was soldered to the distal of the lock to rest against the right second molar. After the patient had become accustomed to this appliance, an arch bar with 29-gauge coil springs was adjusted to the mandibular teeth and ligated to the six incisors to bring them forward. When the left molar had been moved to normal buccal occlusion, a spur was soldered to the

distal surface of the lock and the second molar was carried buccally with the first. A 24-gauge auxiliary spring was soldered to the right side of the lingual appliance and extended to the second premolar on the left side. With this leverage, the premolars were moved buccally. A finger spring was also soldered to the left side to assist in the widening of the canine region. Number 6 rubber bands were worn throughout the treatment.

In ten months the teeth were in very good occlusion. In the next two months I made only a few minor adjustments, and then made the retaining appliance, Fig. 3.

In the mandibular arch the body wire was unsoldered from the locks, and a new 19-gauge wire was adapted to hold the mandibular teeth in normal position. Since this lock was cemented in place, there was no movement of the lingual bar, so the teeth were held in their normal position.

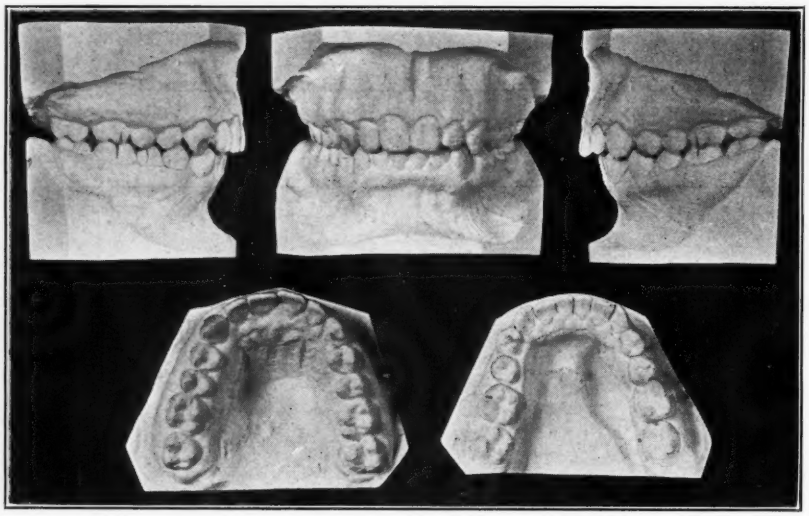


Fig. 4.

In the maxillary arch, bands were placed on the canines, and a bar was soldered to rest on the lingual surface of the lateral and central incisors. A spur was soldered on the labial surface to rest on the lateral incisors; also a spur was soldered to engage the intermaxillary rubbers. These were worn continually for six months, when the patient was instructed to wear them at night only. This was continued for another six months; then he was allowed to wear them twice a week for another six months, then was instructed to leave them off entirely. The appliances were allowed to remain on another six months, as the teeth showed no tendency to go back to their original position. At the end of that time the appliances were removed. I might add that the bands were recemented every six months during the course of treatment.

I gave the patient muscular exercises to do, but I do not think he ever did them except when he came to the office. Otherwise, he was an exceptionally good patient.

Fig. 4 shows the models made about a year after the appliances were removed. The teeth have stayed in very good position.

Fig. 5.

Fig. 6.

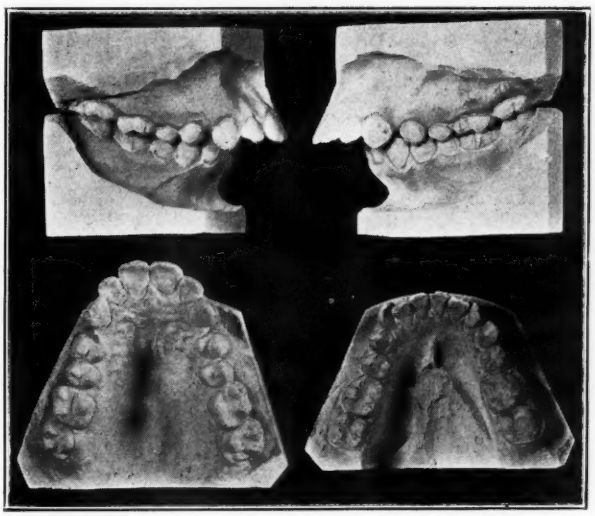


Fig. 7.

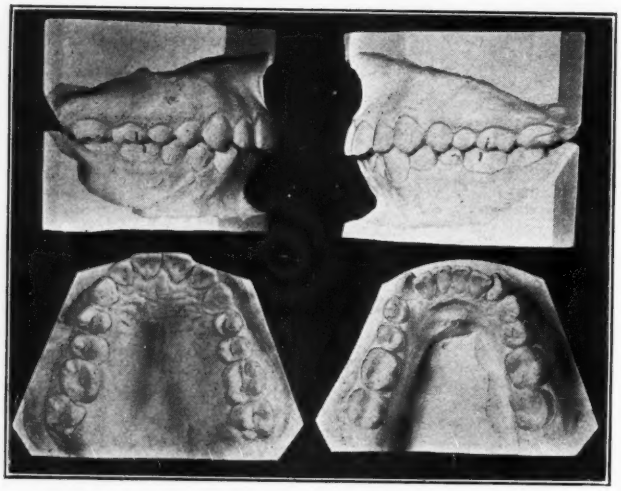


Fig. 8.

Fig. 9.

Fig. 10.

Figs. 5 and 6 are photographs showing the patient before and after treatment. I was rather disappointed in Fig. 6; I thought the chin would show more development since the mandible was moved forward bodily.

CASE 2.—Bilateral distoclusion with labioversion of the maxillary incisors. The patient was a girl seventeen years of age. This is a case of a typical bilateral distoclusion with extreme labioversion of the six anterior maxillary teeth, Fig. 7.

When I started the treatment, owing to the age of the patient and the extreme malocclusion, I decided to extract the first two maxillary premolars, but for some reason I delayed this until the appliances were placed in position, and then the teeth began to move so nicely that I decided to wait and see what results I would get without extracting.

The appliances I used in this case were very similar to those used in the preceding case, except that this patient did not wear a bite plane and there were no coil springs used on the maxillary arch until the latter part of the treatment, when they were applied to push the maxillary molars distally. I find these coil springs very useful in the distoclusion cases where the mandibular molars seem to have come forward as far as they will, and still are not quite in mesial distal relation. By the aid of the coil springs the maxillary molars were pushed slightly distal and the teeth dropped into this normal position. It took about a year to get the teeth in normal relation; then the lingual appliances were remade to fit against the teeth that had been moved, and the use of intermaxillary rubbers was continued, as in the preceding case.

At the end of the second year, a Hawley retaining plate was constructed, and the patient was instructed to wear the retainer if she noticed the maxillary teeth moving forward. I did not take impressions when the appliances were removed. Fig. 8 shows how the case looked a year after all the appliances had been removed. A normal mesial distal relation had been maintained. There is no protrusion of the maxillary anterior teeth. In the mandibular arch, however, the four incisors have returned to their original position.

Figs. 9 and 10 are photographs of the patient taken before and after the treatment. She has done her muscular exercises faithfully, but I do not think that her lips are any less flabby. I think that Nature showed more intelligence than I did when she let those four mandibular anterior teeth drift back to their original position, as this drifting back has tended to make the lower lip less prominent.

About a month ago I gave the patient an equilibrator designed by Dr. Hoey to see if it would help the appearance of her lips.

MAINTENANCE OF FACIAL FORM AFTER REMOVAL OF RIGHT HALF OF MANDIBLE

By George M. Anderson, D.D.S., Baltimore, Md.

ON JULY 12, 1928, "a small bony nodule was discovered on the buccal side of the right mandibular second molar." There was a slight separation of the first and second molars. Diagnosed as "epulis of bony variety." Two days later, the second molar and part of the buccal plate were removed. September 25, examination revealed "fungating tumor extending from the

Fig. 1.—Dental film of first and second molar region, teeth removed. Taken five months after onset and two months previous to operation for removal of right side of mandible.

Fig. 2.—Epulis, illustration of another recent case (Courtesy of Dr. B. Lucien Brun, Baltimore, Md.).

canine to the third molar," involving both sides. Microscopic picture, "epulis without giant cells." Treated with radium. Improved. During December, 1928, and January, 1929, the condition became worse. Swelling, sloughing. February, 1929, there was a considerable swelling of the right side of jaw with an internal manifestation of a "grayish white foul-smelling mass" as

Presented at the Thirtieth Annual Meeting of the American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

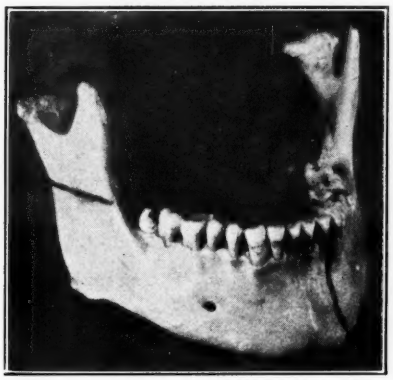


Fig. 3.—Mandible so marked as to indicate section removed.

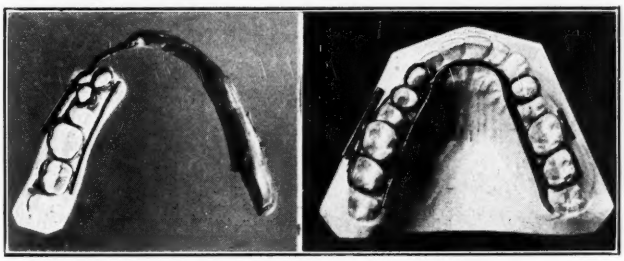


Fig. 4. Fig. 5.

Fig. 4.—Plaster cast, left side of mandible, with plantinous-gold anchor bands so made as to have but one thickness of material (0.007) between the teeth. Lingual bar (10-gauge). Buccal tube, square inside and outside, with square wire (10-gauge) attached to which is tissue stretcher first used, made of celluloid. It was polished very smooth originally but has since dried out, which accounts for the apparent roughness. When placed in mouth it was well-covered with vaseline and could be slipped from tube for cleansing at will. Note that it was kept well free of possible contact with the mesial end of the remaining section of mandible so as to prevent irritation. Also note that lingual bar is soldered to first and second molars and then to canine, and that the buccal tube is soldered to the first molar and first premolar. In cementing the first time, due to difficulties encountered in the limited working field, an effort was made to cement only two bands, the first molar and the canine. Later, all bands were cemented.

Fig. 5.—Upper fixed splint. Bands made similar to those in Fig. 4. Round lingual bar (10-gauge). Right buccal tube (square, 10-gauge). Left buccal tube (square, 19-gauge). In cementing bands the first time due to limited working field effort was made to cement but one molar and premolar on each side. Later, all bands were cemented. This impression was taken in three sections due to inability to place large enough tray in the mouth. Sections were then assembled, and the splint was constructed, after which the splint was cemented to the teeth.

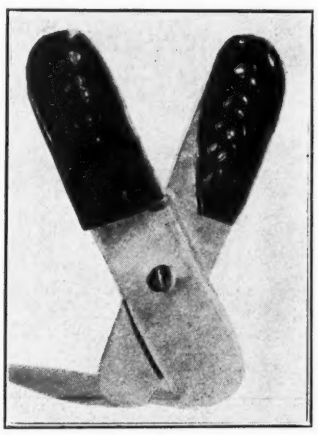


Fig. 6.—Two pieces of aluminum, joined with screw. Used to obtain bite so that sections of upper impression might be assembled. Were folded together so that they could be easily placed in the mouth, then spread apart and pressed up against occlusal surfaces of maxillary teeth, which made an imprint in soft wax. Folded together after breaking free from occlusal surfaces and removed from mouth. The correct width was determined by taking a knife and drawing a line down each edge of the top piece of aluminum while the bite was being taken, which made a mark on the under piece of aluminum. On removal from the mouth all that was necessary to get correct width was to open the two pieces until the edge of the top piece of aluminum came directly over the mark on the under piece.

Fig. 7.

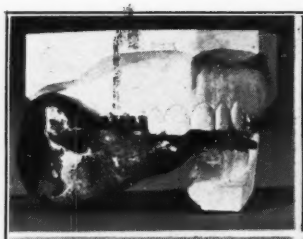


Fig. 8.

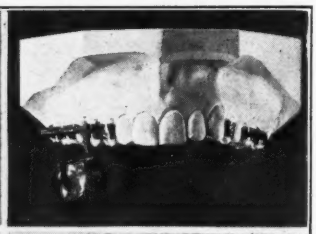


Fig. 9.

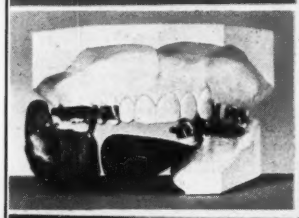


Fig. 10.

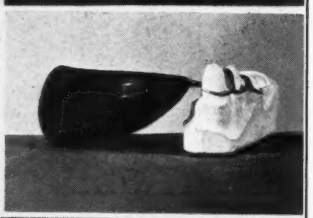


Fig. 11.

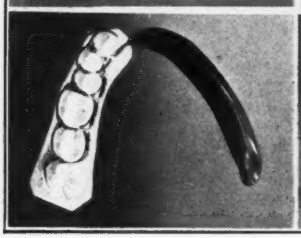


Fig. 12.

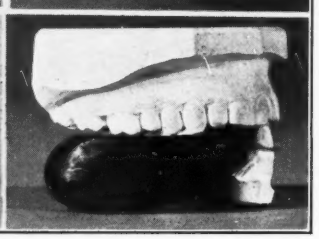


Fig. 7.—Side view of tissue-stretching device shown in Fig. 4. Is attached only to lower splint by square wire entering buccal tube. Upper cast is used here simply to show relative position. Roughness of device is due to the celluloid drying out. Was very smooth and well lubricated with vaseline while in use.

Fig. 8.—Support from upper splint used to keep lower tissue-stretching device shown in Fig. 4. and Fig. 7 in correct position. This support came down lingual to the lower device and was made from polished vulcanite attached to a piece of square (10-gauge) wire which entered the buccal tube attached to the upper splint. This support was, like the others, removable at will for cleansing, and could only be taken out *after* the lower was removed and replaced *before* the lower was inserted.

Fig. 9.—Lower lip tissue stretcher extending from square tube on the lower splint. Additional stretcher extending from buccal tube of upper splint. Each section easily removed for cleansing and more comfortable than one large stretcher covering the same area, the two sections shown being substituted from time to time for that shown in Fig. 4 and Fig. 7.

Fig. 10.—Lower crib splint and facial form maintainer. Removable for cleansing. Not the original. Of highly polished vulcanite and always well lubricated with vaseline.

Fig. 11.—Occlusal view of Fig. 10. Cribs of approximately 21-gauge with lingual bar of 18-gauge round wire, extending into highly polished vulcanite. Extends as far distal as the third molar region and shows the flat occlusal surface on which the maxillary teeth occluded.

Fig. 12.—Side view of Fig. 10 showing how the maxillary teeth occluded with the vulcanite, thereby preventing elongation of the maxillary posterior teeth.

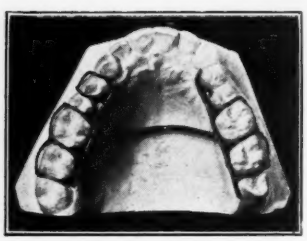


Fig. 13-*A*.

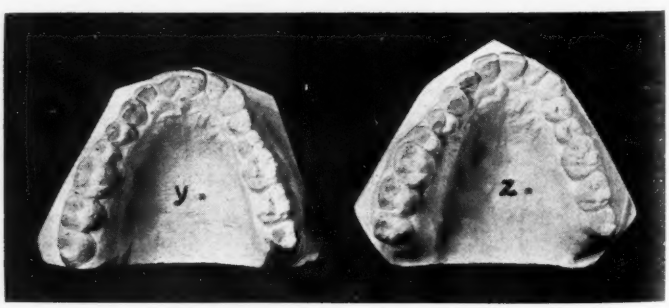


Fig. 13-*B*.

Fig. 13.—*A*, Upper removable splint, palatal bar of round (10-gauge) wire, lingual portion of crib of 18-gauge round wire and cribs of approximately 21-gauge round wire. Constructed to prevent lingual constriction of maxillary arch, particularly on the right side, and to be worn in conjunction with lower removable splint and form maintainer shown in Fig. 10.

B, Model "y" duplicate of cast shown in *A*. Model "z" cast of maxilla two years after operation showing constriction that has occurred in maxillary right canine and first premolar region. The crib-splint shown in *A* was not worn as planned to prevent this anticipated shrinkage which has now unfortunately occurred. An excellent illustration of changes incident to moderate pressure over a prolonged period.

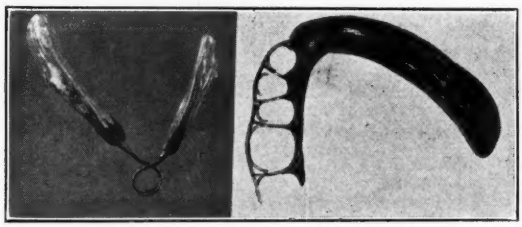


Fig. 14. Fig. 15.

Fig. 14.—Tissue stretcher and exerciser. Made of 16-gauge round wire and polished celluloid. Original used. One side is removable, having a tube embedded in celluloid into which round wire enters so as to facilitate placing exerciser in mouth. Used at varying intervals as a valuable aid to bringing facial form toward normal.

Fig. 15.—Vulcanite and crib now being worn by patient, in fact has been in use over a year.

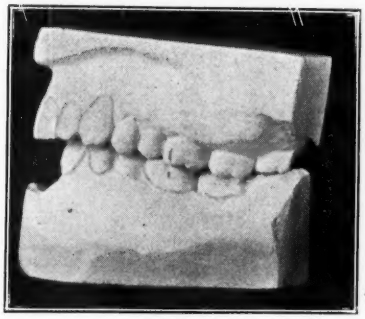


Fig. 16.—Photograph of remaining left side showing occlusion with upper two years after operation and one year after constant wearing of form maintainer shown in Fig. 15.

Fig. 17.—Extraoral view of remaining teeth, left side. Some slight absorption of process, two years after removal of opposite side of mandible and after one year of constant wearing of facial form maintainer.

high as the teeth, about the size of a bantam's egg, which made eating difficult and interfered with breathing. Had lost forty pounds.

February 7, 1929, right side of mandible was removed just above the angle and extending to the left canine. (See INTERNATIONAL JOURNAL OF ORTHODONTIA, ORAL SURGERY AND RADIOGRAPHY, **17**: 279, 1931, reported by Goodsell of similar operation.)

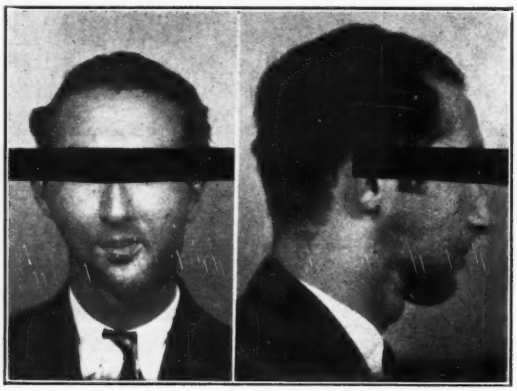


Fig. 18. Fig. 19.

Fig. 18.—Facial appearance, two years after operation.
Fig. 19.—Profile, two years after operation.

February 19, began work on proposed appliance for maintaining facial form. Completed by February 27. Tissue-stretching appliances were worn for nine months, then a removable appliance was constructed which the patient is wearing to this day.

Appliance tolerance satisfactory. Facial form near normal. Contemplated bone graft and plastic surgery unlikely.

X-ray pictures, February, 1931, indicate absorption of remaining ramus and condyle on right side.

CASE REPORTS*

By Harold Chapman, L.D.S., London, W. 1, England

INFANTILISM AND OCCLUSION

THE dental condition, from the orthodontic point of view, of cases of infantilism has not been reported on, so far as I am aware; the opportunity is taken to present two cases.

Details of Case 1 (Figs. 1, 2 and 3). Male, aged twenty-four years. Infantilism—type Lorain (pituitary tumor). Cheerful mentality. Occupation—clerk. Height 4 ft. 3½ in. Weight 4 st. 3 lbs. Calvarium large, out of proportion to rest of head. Dental arches very small; teeth very crowded. At age of eighteen years four teeth were removed from the mandible and two from behind the maxillary centrals; doubtless there have been other extractions not recorded; several teeth are carious. Though the arches are small and in proportion to the rest of the face, the teeth are the size of those of an ordinary adult; the width of the maxillary central incisors is 8 mm. The arch relationship is probably normal.

Details of Case 2 (Figs. 4 and 5). Male, aged fifteen years. Infantilism. Dr. Robert Hutchinson says that he supposes that "some people would put the cause down to an anterior lobe pituitary defect." Height 4 ft. 2 in. Weight 4 st. 2 lbs. (His brother, aged twelve years, is slightly taller and heavier.) Occlusion normal; the maxillary central incisors are 7.75 mm. wide; teeth excellent, the only defects being a few small cavities; there is only one right mandibular premolar, and this is not perfectly formed, but the deciduous mandibular canine is in place on that side between the permanent lateral and canine; the latter occludes between the maxillary canine and first premolar; there is much calculus on the six mandibular front teeth. X-ray pictures and photographs are not available.

This child was so tiny when born that he "could have been put into a quart pot." He thrived and got fat until he was four years of age; was breast-fed for nine months. For a long time he ate very rapidly, in fact, bolted his food, but he eats slower now. His father is certain he did not masticate his food until he was thirteen years of age; he swallowed it rapidly in order to get out to play. He had a dummy from age four months to ten months. At night he was not entirely a nose breather; tonsils and adenoids were removed at age eleven years. He had rickets very badly at four years of age; he ceased to grow at age twelve years. These details are of interest because they bring out the fact that this boy was subjected to a number of reputed causes of malocclusion, yet he has splendid arches and correct arch relationship.

*Transactions of British Society for the Study of Orthodontics.

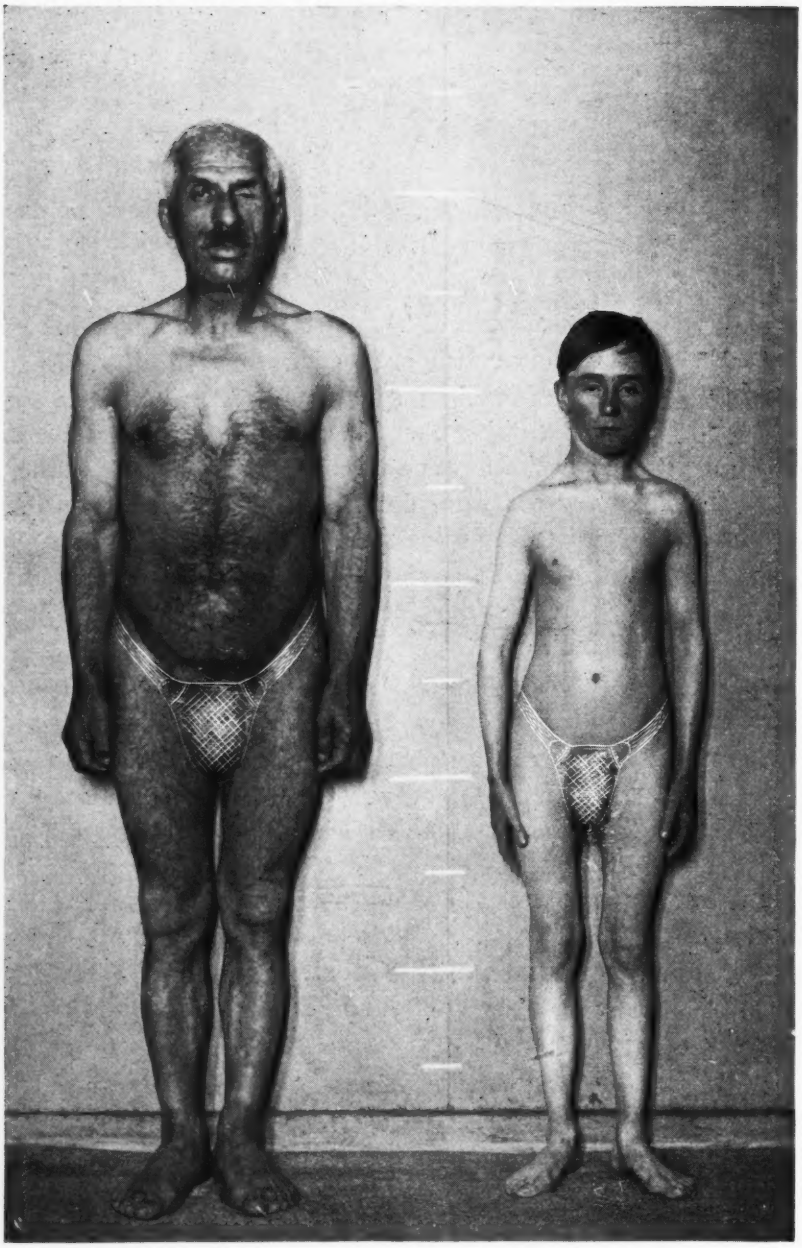
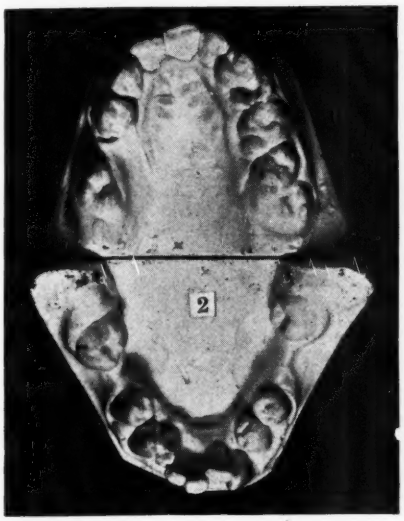
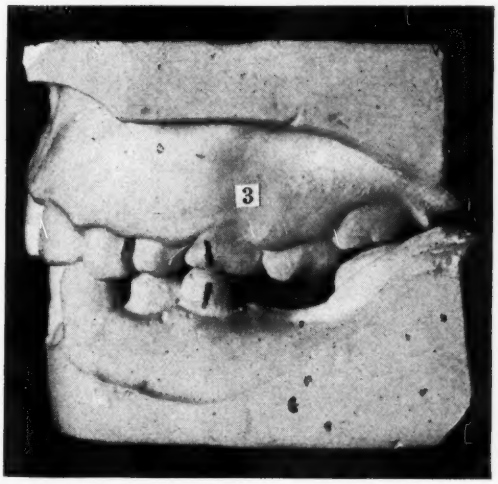
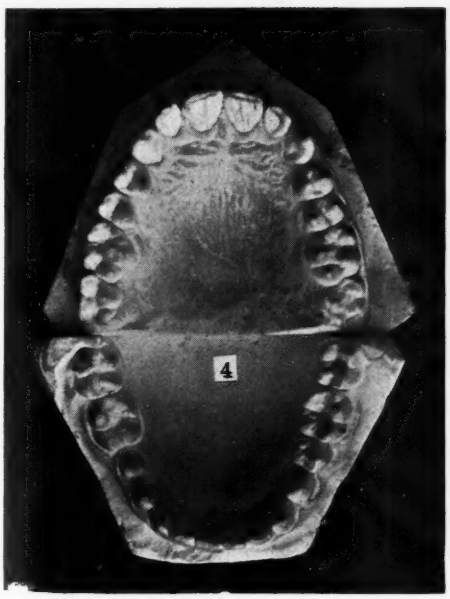


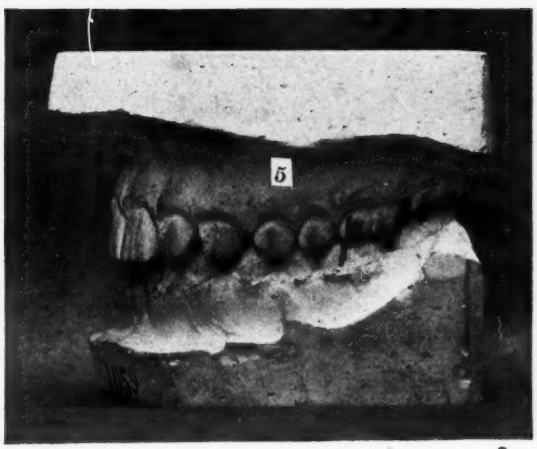
Fig. 1.—Photograph of the patient whose models are shown in Figs. 2 and 3. He is standing next to a man suffering from acromegaly, whose height is just under 5 ft. 6 in.

There is no sign of puberty or thyroid insufficiency. He is intelligent. His physical development is perfect, but he is too small, except in regard to the head and face, which are normal in size. His brother has no features out of the ordinary.









Considerable research work has been done to show that physical defects of parts of the body other than the head and face, are concomitant with maldevelopment of the masticating face and the occlusion. The first case shown may be cited as an example. The second case is an example of perfect development of the masticating face, including occlusion, but deficient development of the rest of the body. The writer is not aware that a case of imperfect development of the masticating face, accompanied by malocclusion, with perfect development of the rest of the body, has been reported, although there is probably not

a practitioner here but could bring forward such a patient. In the light of what has been stated above, the following combinations of occlusion and body development seem to exist:

Masticating Face and Occlusion	Development of the Rest of the Body
Normal.	Good. / Imperfect.
Abnormal.	Good. / Imperfect.

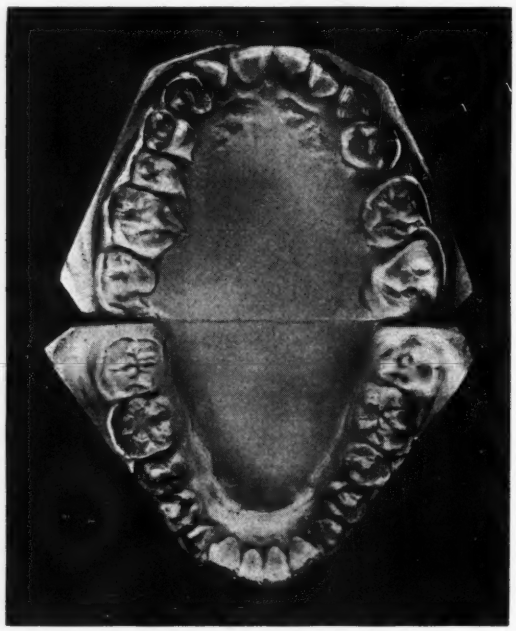


Fig. 6.

AN IMMOVABLE TOOTH

Girl, aged thirteen years five months. (Figs. 6, 7 and 8.)

Occlusion.—Class I; abnormal medial movement of the left maxillary permanent molars. The left maxillary central and lateral incisors are almost edge to edge with the mandibular teeth; the maxillary right central incisor has good overbite. X-ray pictures show that the root of the left central incisor has been almost entirely absorbed; the other maxillary incisors have roots normal in length.

History.—At age eleven years the left central overlapped the right one; the former was pulled distally by rubber bands; to hasten treatment three bands were used simultaneously; the left central incisor was almost extracted; it was pushed back and held in position; the probable duration of this period was about four weeks. At the age of thirteen years five months the left central incisor seems to be getting shorter than the corresponding tooth on the right side. At age twelve years nine months the second left maxillary premolar was extracted.

Treatment.—The advice given was that the condition of the root of the left central incisor was unfavorable to treatment with appliances, but the appearance would be improved if the right central incisor were shortened by grinding.

Three and a half years later a friend of the writer reported that he had attempted to elongate the left central incisor, but, instead of moving, it had moved every tooth in the head.

Fig. 7.

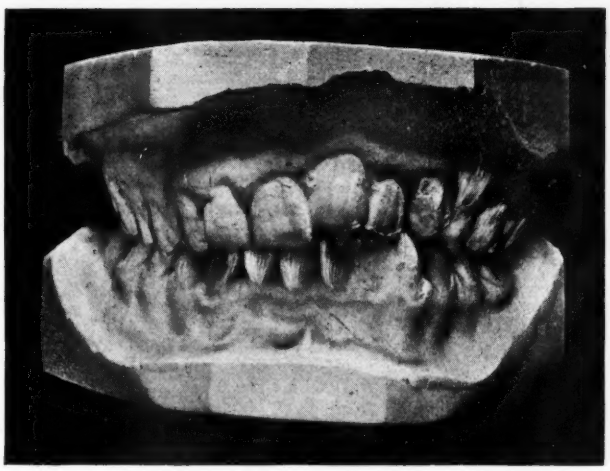


Fig. 8.

INJURY TO INCISORS

Boy, aged eleven years nine months. (Figs. 9 and 10.)

Occlusion.—Class II, division 1. Unilateral on the right; normal on the left; the left maxillary permanent molar has moved medially to an abnormal extent; the overbite is excessive. General condition of the mouth is good.

History.—At age eight years nine months the right maxillary central and lateral incisors were knocked out in an accident; the central incisor was replaced at once and remains as seen in Fig. 9. The left maxillary lateral responds normally to heat, cold and electricity; both centrals respond much more slowly to cold and electricity; no response to heat was obtained; the

degree of response of the two teeth seemed to be similar; the x-ray pictures (Fig. 10) show the left central incisor root to be in better condition than that of the right central incisor; no difference in the three incisors to palpation could be detected.

The lateral was also replaced after the accident; as it went black it was extracted.

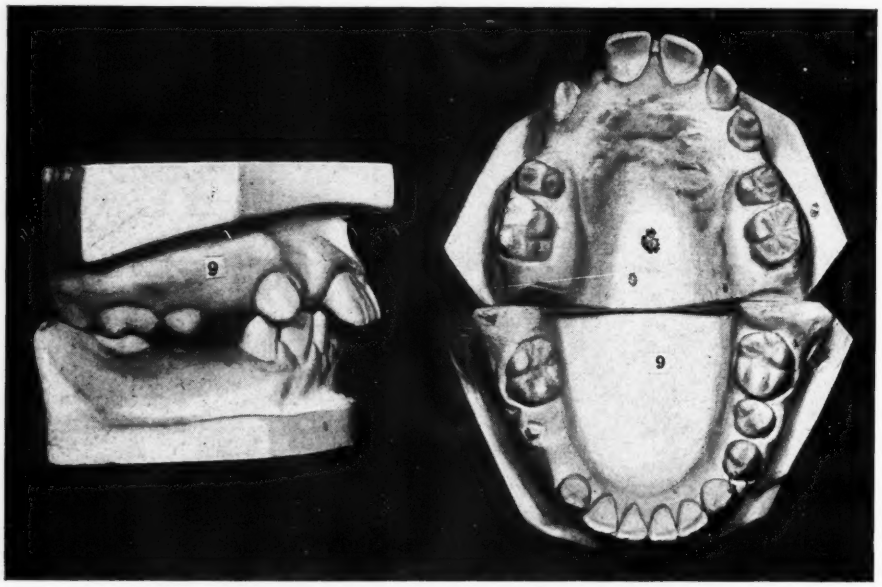


Fig. 9.

Fig. 10.

The two first maxillary premolars were extracted at age nine years nine months, presumably with the object of facilitating orthodontic treatment. The right central incisor is said to get loose when it is moved.

The parents wish to know if orthodontic treatment is contraindicated. My opinion is that orthodontic treatment would confer little benefit and should not be undertaken unless the parents realize that permanent retention may be required and that the treatment may cause the central incisors to be lost earlier than would otherwise be the case; in any event artificial substitutes will probably be required in a few years.

15 Upper Wimpole Street.

DISCUSSION

Mr. A. T. Pitts said that the first of Mr. Chapman's communications raised some quite interesting questions, and suggested an investigation which might be worth carrying further. He had seen a good many children with infantilism, but had never been able to correlate any particular dental condition. There were various kinds of infantilism; the two examples shown by Mr. Chapman were of dyspituitarism. He had seen some of these, and here again he could not recall any particular abnormalities in the dentition. Then there was renal infantilism, and in one case of this type he had seen a very marked retardation of the eruption of the teeth in a child of about eight or nine years, though in other cases he had not been able to observe any particular correlation. One might sometimes see very profound conditions affecting the whole body, and yet the teeth and jaws might be absolutely unaffected. He recalled one child of ten years, with the physical development of a child of six—a wizened creature—although mentally extremely alert, she had suffered from cyclical vomiting for many years, yet here again the jaws were perfectly well-formed, and there was not a trace of caries in the mouth. It would be very interesting indeed to correlate on a larger scale some of these conditions.

Mr. H. C. Visick remarked that in the second of Mr. Chapman's cases, where there was apparently absorption of the root, it seemed almost an impossibility that a tooth with such a short root could resist movement with orthodontic appliances. If other photographs showed the root at right angles, that would explain it, otherwise it seemed inexplicable, especially as an attempt was made to pull it out of the socket. He had often noticed that the roots of teeth killed by a blow had slowly become absorbed away until they had just the appearance shown in the photograph. The tooth did not become septic, the pulp chamber seemed to be dried right up, and the tooth generally discolored, and there was hardly any root. The x-ray photograph which had been shown suggested to him a case of that sort.

THREE CASES AND THEIR TREATMENT*

By G. F. Cale Matthews, L.D.S., London, W. 1, England

THE first case is a child of eight years and five months, with bilateral post-normal occlusion. I show the case corrected (Fig. 1). I would point out the marked depth of the first premolar development. I am more and more

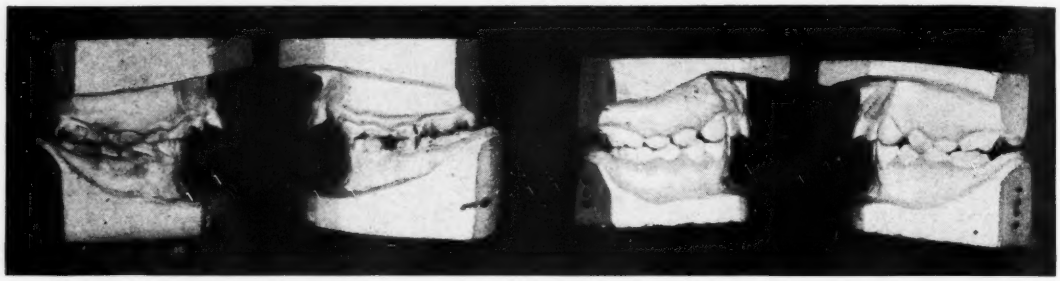


Fig. 1.—First two models were made when the patient was eight years, five months old. The last two models were made when the patient was ten years, eight months old, September, 1930. Note the forward movement of the mandible. No intermaxillary traction. Treatment to allow vertical growth to correct occlusion of posterior teeth.

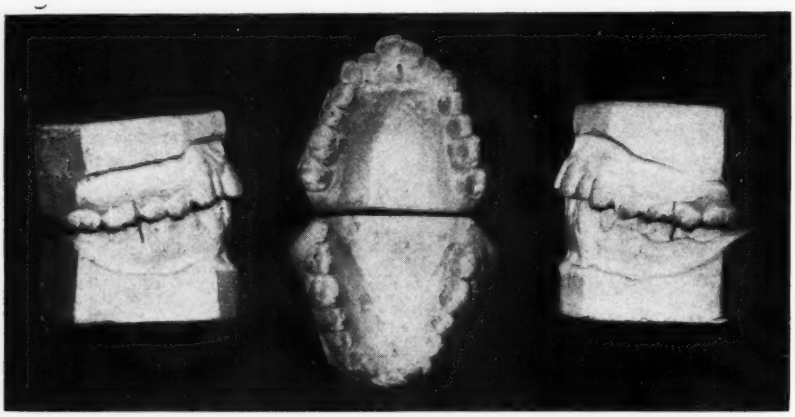


Fig. 2.

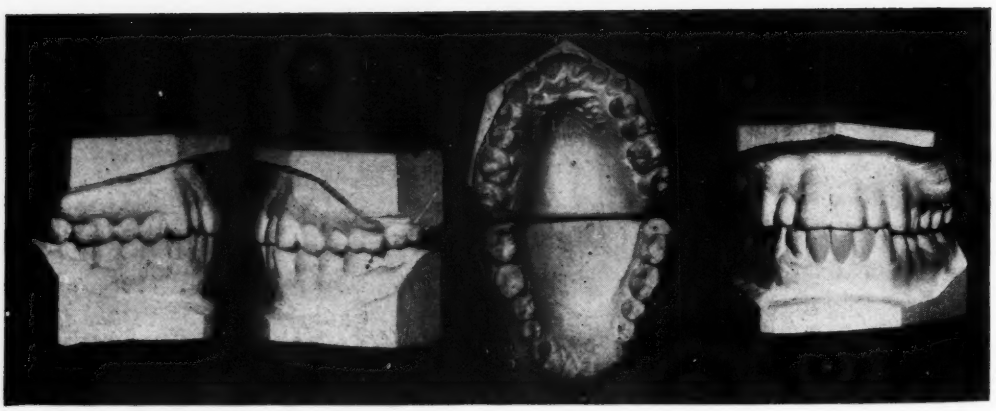


Fig. 3.

*Transactions of British Society for the Study of Orthodontics

convinced in the cases of postnormal occlusion that the first premolar is the most important tooth in maintaining normality.

The second is a case of normal occlusion in relation to the first permanent molar. I show the patient after thirteen months' treatment. Patient aged sixteen years. (Figs. 2 and 3.)

Fig. 4.—Unfortunately I kept the models sent with the patient, which are slightly broken, and did not make new ones. This case was only a very short time under intermaxillary traction. Ordinary simple vulcanite retainers with no action. Worn until September, 1930. No change in occlusion during fifteen months.

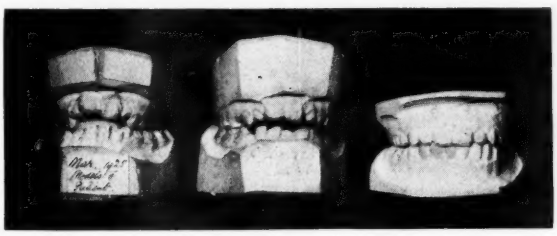


Fig. 5.

The final case is one of postnormal occlusion. The earlier models, taken in March, 1925, were sent with the patient. I show them and, for comparison, the later models. Patient aged eight years. (Figs. 4 and 5.)

(Mr. Cale Matthew's short communication was illustrated by a large number of models and slides.)

79 HARLEY STREET.

DISCUSSION

The *President* said that members would have seen with great pleasure the beautiful results that Mr. Cale Matthews had been able to obtain. He would like to ask whether, in obtaining these results, he had made use of force applied in such a manner as to move the teeth in a tilting direction, rather than in the manner which he would describe as a root-moving direction—in other words, whether his force applied to the crowns of the teeth had moved the crowns first in the hope that the roots and the bone supporting those roots would move afterward, or whether he had moved the teeth in a direction parallel to the long axis of the whole of the teeth. The question was a difficult one to frame, but he thought Mr. Cale Matthews would understand his meaning.

Mr. H. G. Watkin asked whether Mr. Cale Matthews had used any intermaxillary elastics in any of these cases.

Mr. Cale Matthews, in reply to the President, said that in the postnormal cases the treatment was directed toward obtaining some function at the earliest possible moment. The cases of postnormal occlusion were aggravated unquestionably by lack of function. The first thing to be done was to endeavor to get function; this, together with any treatment

which might be adopted in the shape of expansion, was a matter for individual liking in the choice of appliances. The first case he had shown, that of a small child of eight years and five months, wore an expansion upper plate with a Badcock expansion screw, and that was altered as necessary, until it was possible to apply with it a combined plane. She wore for a short period intermaxillary traction. When the premolars were erupted, the appliances were put aside for a time and she was placed on exercises.

The second postnormal case, which he considered an extremely severe one, was treated very much in the same way, only the intermaxillary traction was more or less casual owing to school accidents with the appliance; it was not consistently worn on account of breakages during more than twelve months out of the four years in which treatment was undertaken.

The ultimate maintenance of the teeth was by fixed molar attachments with lingual and labial arches—plain wire arches—and exercises. In both these cases the children were of good parents, who were extremely interested, and assisted in every possible way. Unless one had seen at close quarters—as he had had the pleasure of seeing it—the work that Dr. Rogers was doing, the enormous improvement in these postnormal cases as a result of exercises would be almost unbelievable. It was really uncanny. He himself had seen at least fifty of these cases—severe postnormal occlusions, with individual teeth misplaced, many of the patients never having worn an appliance of any sort—some had been entirely corrected with exercises. No one else appeared to get these results. There were plenty of men who were using exercises as auxiliary to the use of appliances, but many of Dr. Rogers' results were obtained on exercises alone.

The question of intermaxillary traction was a very important one, and here he desired to interpolate a remark on the case which the President himself had shown earlier in the evening. That case was just the reverse of the one he himself had shown. The excessive growth in the President's case was in the mandible, while in his own case the excessive growth was in the maxilla. If this latter persisted one might get stagnation—a very much more stabilized condition of the abnormality. The President had not made it quite clear whether in his case he had located the second maxillary molars. (The *President:* Yes, I had done so.) The treatment of such a case was to get the individual teeth into position, and then to start out to get a correct relation of the mandible to the maxilla. The other way, that of endeavoring to establish the relation of the mandible to the maxilla, and of then placing the teeth into position, was not to be advised, because in that case no assistance was forthcoming from mastication. That was how he would start out to treat the President's case now. He would individually place the teeth, and then set out to get the correct relation.

A CASE FROM PRACTICE*

By H. E. Marsh, M.C., L.D.S., Sussex, England

I AM going to show models of a case from practice which is, I think, of some interest. The photographs and casts are from a child aged twelve and one-half years, and I bring the case to your notice because of the remarkable disparity between the development of the maxilla and of the mandible. You

Fig. 1.

will observe that the maxillary right lateral incisor is missing, and the central incisors have moved over to the right side to some extent. The canine is unerupted, and the maxillary second molars at twelve and one-half years had not appeared. In the mandible, which had been subject to orthodontic treatment, I may say, the second molars were fully erupted when the child was ten years of age.

*Transactions of British Society for the Study of Orthodontics.

I would ask you to pay attention to the amount of space which exists already between the premolars, and between the small lateral incisor and the canine, which is partially erupted, and, in fact, all round the maxilla, as compared with the quite close contact between all the teeth in the mandible. Apart from the right lateral incisor, there is not much disparity in the size of the teeth.

I show a radiogram of the left side of the maxilla, taken at the age of ten years. It shows the permanent lateral incisor, the permanent canine, the deciduous canine, the permanent first premolar and the first deciduous molar. I show also the right side. I may say that when I first saw this case two years ago the permanent central incisors (the mandibular incisors) were definitely biting inside. This case has had intermaxillary traction with elastics. Two years ago the disparity between the size of the mandible and the size of the maxilla was not nearly so marked as it is at present. The chin has simply continued to grow. There appears to have been very little growth in the apical region in the maxilla, and very great growth in the mandible.

I had the benefit of a consultation with Mr. Harold Chapman about this case eighteen months ago. I rather wanted to remove the two mandibular first premolars, which he was very much against doing, and I now feel quite sure that he was right, because had that been done, and had I been able to move back the mandibular incisors and canines with a view to closing the space, the angle of inclination of the mandibular incisor teeth would have been moved back still further than it is at present, and would have further emphasized the size of the process of the chin.

Finally, I show you the models in articulation, and the small size of the lateral incisor is apparent. The appearance of the child, instead of improving, so far as I can see, continues to grow rather worse. I should be very glad to hear the views of any who are inclined to comment on this case. It is a case which has caused me a good deal of anxiety, and I should be very happy to assist the little patient beneficially.

1 Cantelupe Road, Bexhill.

DISCUSSION

Miss Russell mentioned that she had an almost similar case. It was in a girl who was now twenty-one years of age. The jaw was practically the same as that shown by Mr. Marsh. She had lost two teeth from the maxilla. The condition looked to her to be gradually getting worse.

Mr. R. Lindsay wondered whether members recalled the fact that Mr. Wilson Charles advanced the theory that there was a certain amount of growth of an obvious character at the condyle which influenced that of the mandible. The speaker believed that at present there was a good deal of investigation on the Continent which seemed to suggest that there was something in the theory. Mr. Wilson Charles was rather scornfully treated by some anatomists when he advanced his suggestion, but these cases helped one to believe that it might be well founded. Curiously enough, one of the orthodontic cases which he had to leave when he gave up practice was just such a case as was now illustrated, and after having got the mandible to a fairly good condition, it was the misfortune of Mrs. Lindsay and himself to witness a gradual relapse and it seemed now that the line of treatment might be more advantageously pursued in the manner suggested in Mr. Visick's question. If one could press back the head of the condyle along the glenoid cavity, one might interrupt the forward tendency and obtain a permanent cure. If that were continued until the rapid rate of

growth in the patient had ceased, a lasting improvement might be expected. He had been rather astonished to hear Mr. Northcroft's suggestion, that by the extraction of certain teeth one could have improved the condition of that mandible. The position of certain teeth would have been altered by such a procedure, but the prominence of the chin could not have been altered by any extraction, and that was the great deformity existing in these cases. One was tempted to consider that extraction in that case and in the analogous cases to which reference had been made would not have been a satisfactory procedure.

Mr. B. Eady said that in support of what Mr. Lindsay had just said he could quote himself as an apparent example of an actual case. From the age of four until he was sixteen years old he had a mandibular protrusion.

Mr. George Northcroft could not quite agree with the opinion of Mr. Chapman which had been quoted that the size of the mandible should not be reduced. He supposed that the possibility of a condition such as acromegaly had been thought of, and, of course, if there were such a condition present no attempt at a reduction of the size of the mandible would do much good. At the same time, the maxilla showed marked lack of development, and as one tooth was absent, it seemed rational to attempt to make the size of the mandible correspond with that of the maxilla by reducing the mandible as well by the loss of one tooth. It was astonishing how much the circumference of the arch was reduced when such a space was closed up, and the teeth once more brought into contact. Possibly such a step might not be considered advisable at the present stage of treatment, but had it been done two years ago, it seemed, in his opinion, it would have brought about a satisfactory result.

Mr. A. T. Pitts said that the fact that the prominence of the chin appeared to be increasing suggested that there might be at work some stimulating element of growth in the mandible. It was possible that the development of the third molar might be stimulating a growth of the body of the mandible; this, combined with rather poor occlusion, might be tending to bring the jaw forward. He agreed that if the premolars were taken out on each side the retroclination of the incisors might look very ugly and accentuate the prominence of the chin; but from another point of view, to break the chain of the teeth in the mandible might be quite a reasonable thing to do. It might be worth while to take an x-ray picture in order to study the position of the third molar and to consider taking out the second molar. He himself believed that the action of the third molar was often a disturbing factor in some of these orthodontic cases.

Mr. Lindsay referred to some experimental work being carried out by Dr. F. Schmidhuber in Germany on the temporomandibular joint. He found that the growth in length of the mandible took place largely from the condyle; any stimulus to that joint caused a growth in length of the mandible. Intermaxillary traction—which she understood had been carried out in the President's case—acted upon the condyle and altered its shape and the shape of the angle, as well as stimulating growth in length. It struck her that perhaps the growth in this instance had been stimulated by such treatment, and no amount of extraction would alter that condition of affairs. In fact, she thought that if the premolars were extracted, while there would be no reduction in size, there would be an angle caused by the incisors which would emphasize the forward protrusion of the chin.

Mr. W. A. Bulleid asked if there was anything peculiar about the tongue.

The *President* replied that the tongue was normal. He added that the child generally was quite bright. As for the hereditary factor, the mother was a quite average little woman, and the child, who was normal in size in every other way, probably inherited her chin from her father, who was a six-feet-four man, with an enormous chin. The features of the child other than the chin were inherited from the mother.

Mr. H. C. Visick asked whether the President had considered the use of a cap with elastics to hold the chin back.

The *President* replied that he had considered it, but had not made use of it.

Mr. H. G. Watkin said that about eight or nine years before he had an almost similar case. This was in a child of about eleven years. No teeth were missing. All the maxillary incisors were inside the mandibular incisors. By intermaxillary traction he was able to get the mouth very nearly normal. She had been a regular patient, therefore he had not

lost sight of her, and now there was about one-half-inch discrepancy between the maxillary and mandibular incisors. The jaw seemed to grow persistently, with nothing to check it, and in some of these cases the mandible grew apparently by virtue of some inherent power which could not be stayed. He thought the extraction of one of the incisors would have been a very good thing. There was a certain number of "bricks" in the top arch, but the number in the lower arch was larger by one. Ten bricks could not be fitted over nine; if the numbers were made equal there would be more chance of a fit. He added that in his own case none of the premolars met at all.

THE TEMPOROMANDIBULAR JOINT*

By S. Wilson Charles, L.D.S., Rickmansworth, Herts, England

THIS joint differs from other joints in that under normal conditions there is no pressure exerted on the joint surfaces or articular cartilage during use.

When teeth are lost considerable bony changes may take place; changes may take place in the auditory apparatus, but the interarticular cartilage appears to be very resistant and would appear to thicken rather than be destroyed by pressure.

The chief interest of the orthodontist is, however, in the growth of the joint and whether this growth can be influenced or not. Observation appears to show that owing to the peculiar type of growth which takes place during development, any external influence to be of any effect must be applied at the earliest possible age.

*Given at a Demonstration Meeting of British Society for the Study of Orthodontics.

THE SEMI-FORMED LINGUAL ARCH READY FOR ADAPTATION TO THE CAST AND MADE IN GRADED LENGTHS*

By Herbert A. Pullen, D.M.D., Buffalo, N. Y.

I HAVE been working for a long time on a semi-formed lingual arch which could be made up in graded sizes and furnished to the orthodontist in such graded lengths that he could first measure the length of the arch wire needed on the cast, and then select the exact length of arch needed from a stock of these graded lengths, and adapt the selected length to the cast by either hot or cold bending as desired.

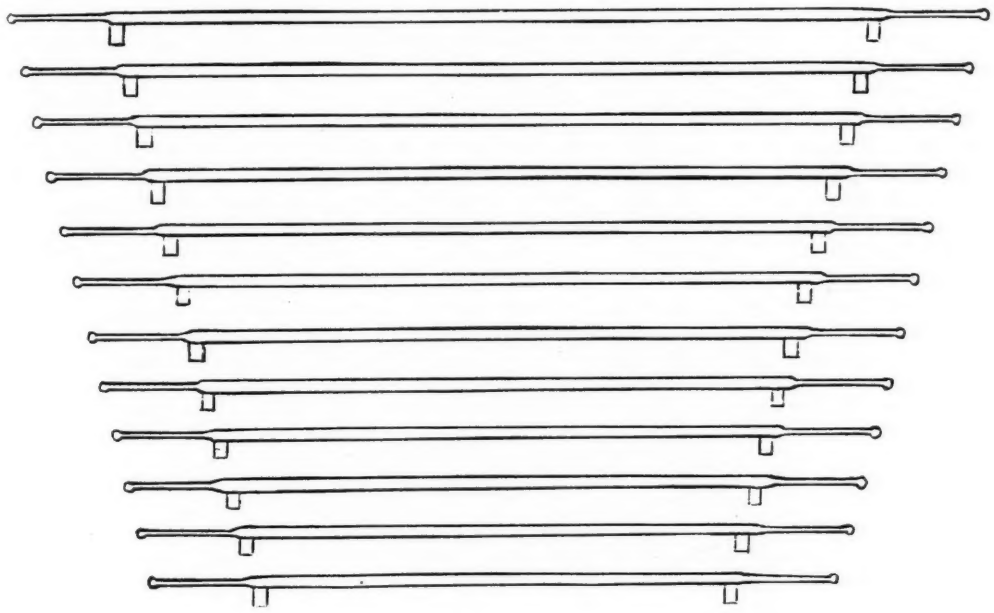


Fig. 1.

Fig. 1 illustrates a graded series of these semi-formed lingual arches with gradations of one-sixteenth of an inch which seem close enough for all practical purposes when auxiliary springs are used for tooth movement or stimulation to growth of the dental arch. These lengths were obtained from the measurements of the lingual side from first molar to first molar of thousands of casts so that all of the possible lengths needed and their gradation in length could be included.

Fig. 2 exhibits some of these semi-formed lingual arches after they have been bent into arch form, ready for adaptation to the cast on which the arch form is perfected by hot or cold bending.

*Clinic presented at the Thirtieth Annual Meeting of the American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

The technic of their use is as follows:

(1) Measure the length of the semi-formed arch needed for a case by adapting an annealed copper wire from the distal end of the vertical tube on the left side of the cast around the lingual side of the arch in exactly the posi-

Fig. 2.

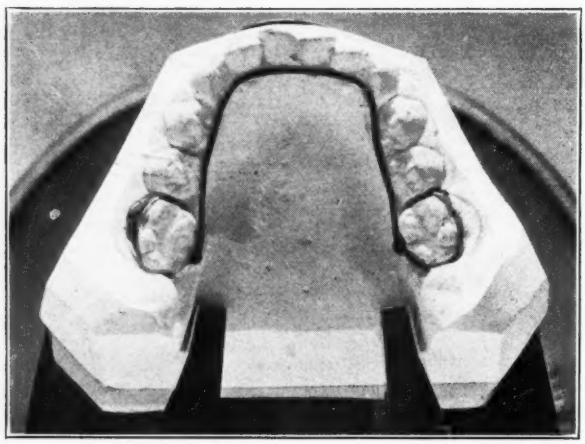


Fig. 3.

tion the finished arch is to be placed, continuing to the distal end of the vertical tube on the right side of the cast, cutting off the remainder of the copper wire at this point, as shown in Fig. 3.

(2) Select one of the graded sizes of semi-formed arches corresponding to the same length as the copper measuring wire from the distal edge of one half-round rod to the other, allowing for the thickness of the vertical tubing, which was included in the previous measurements as shown in Fig. 4.

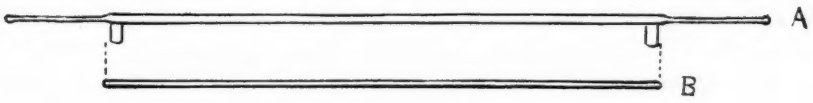


Fig. 4.

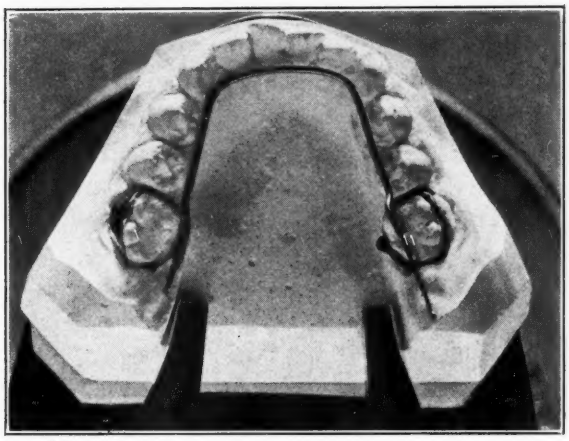


Fig. 5.

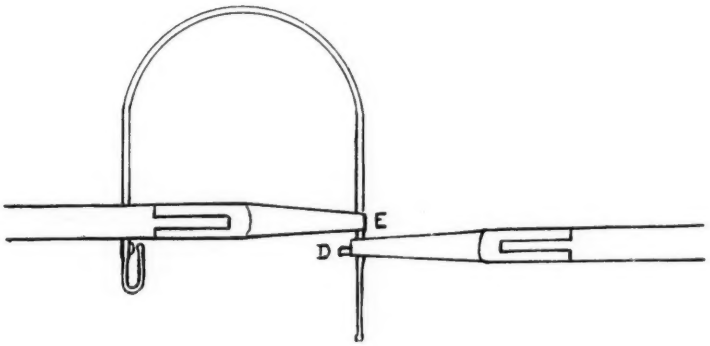


Fig. 6.

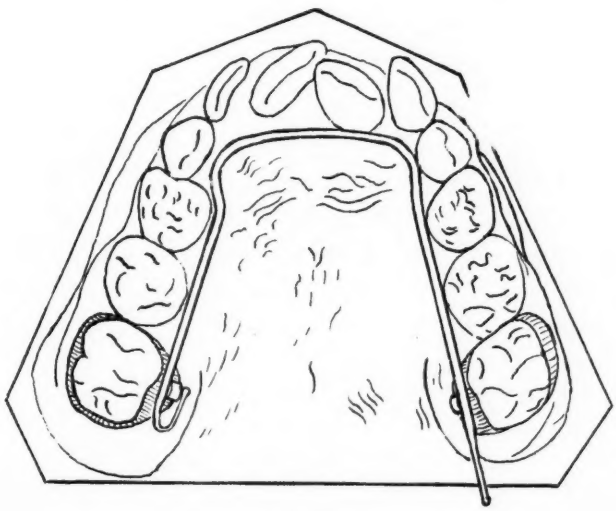


Fig. 7.

(3) Beginning on the left side of the cast, place the half-round rod of the selected semi-formed arch in the half-round tube on the molar band on that side, and adapt the arch by either hot or cold bending to the lingual side of the teeth continuing around to the lingual tube on the right side, as shown in Fig. 5.

(4) Adjust the vertical rod on the right side to registration with the vertical tube on that side by slight rotation of arch wire with two pairs of pliers, as shown in Fig. 6.

(5) Place right half-round rod in vertical tube, bend the end pieces of reduced diameter of the semi-formed arch into their locking positions, when the semi-formed arch is ready for the attachment of auxiliary springs, Fig. 7.

The use of such a semi-formed or ready-made arch is obvious in that time in construction of the finished appliance is reduced considerably, which is of great value when the orthodontist constructs his own lingual arches.

Again, a manufactured semi-formed arch will have no excesses of solder in the union of the half-round rods to the arch, as not infrequently happens to the joints soldered by the orthodontist or laboratory technician.

Another advantage of no slight importance is the locking wire of reduced diameter, 0.022″, which, being part of the semi-formed arch, does not require attachment by solder.

Finally, the clinic represents an effort to take part of the tedious work of manufacture of the lingual arch out of the hands of the orthodontist and place it in the hands of the manufacturer, who can save the time and effort of the orthodontist and produce a more perfectly made apparatus for the purpose intended.

CAST RETENTION PLATES

By Percy Norman Williams, D.D.S., Tucson, Arizona

TO ONE who has had any great amount of experience with a vulcanite plate for retaining the mandibular arch, the problem of retaining such a plate is a serious one.

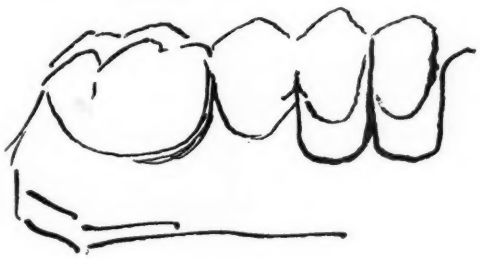


Fig. 1.

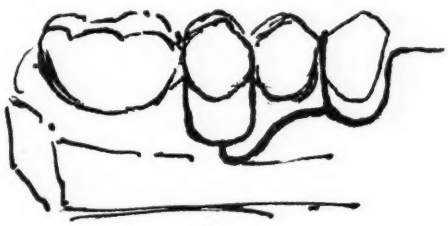


Fig. 2.

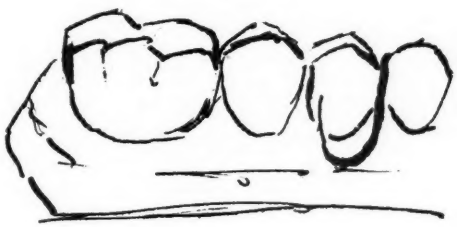


Fig. 3.

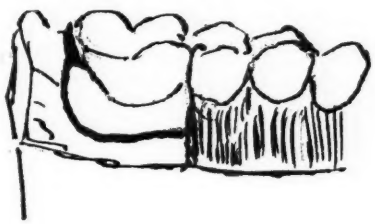


Fig. 4.

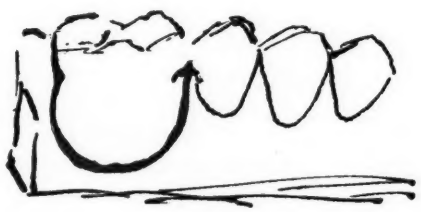


Fig. 5.

While it is true that the majority of patients soon master such an appliance, it does not necessarily mean that the plate is down against the tissues and safely holding the teeth. After many failures, I have sometimes resorted to the lingual wire, but it is desirable to get rid of the bands at the earliest date and to substitute a removable appliance. The success or failure with a vulcanite plate, assuming the fit is correct, depends almost wholly upon the method of clasping.

This clinic attempts to show several types of clasps. Some of the designs were demonstrated to me by Roach. Others are the result of years of experimentation.

Clinic presented at the Thirtieth Annual Meeting of the American Society of Orthodontists, St. Louis, Mo., April 21-24, 1931.

It must be borne in mind that the problem of clasping and retaining partial dentures is quite different from clasping retaining appliances. There is one place where a wire can pass over between the teeth. This is between the canine and premolar. Utilizing this space, I am showing several types of clasps for this clinic.

Fig. 1 shows a very effective and efficient clasp. This clasp will hold the plate so securely that the patient may have difficulty in removing it. Care should be taken not to adjust it too tightly.

Fig. 2 shows another type. This has almost twice the clasping power of Fig. 1. Since more leverage is exerted, the wire passing over the teeth must be heavier. Care should be taken not to allow the clasp points to impinge upon the gums.

Fig. 3 shows another type. This clasping power depends upon finding an undercut on the buccal surface of the tooth.

Fig. 4 shows a clasp below the distal contact point on the first molar.

Fig. 5 is the same as Fig. 1, but is shown on the molar.

These designs have been used with vulcanite, gold, and silver plates. Cast silver plates can be used where the patient's circumstances do not permit the use of gold.

Plates can be cast directly to the plates, or the clasps can be made and soldered to the plate.

I find cast plates more hygienic, easy to repair and much less bulky.

THE HAWLEY REMOVABLE RETAINER

By Donald Hutchinson, D.D.S., New York, N. Y.

THE purpose of this clinic is to present the only officially recognized removable appliance.

Dr. C. A. Hawley introduced this type of appliance and gave credit to Dr. McBride, of Dresden, Germany, for the vital principles of it.

Figure 1

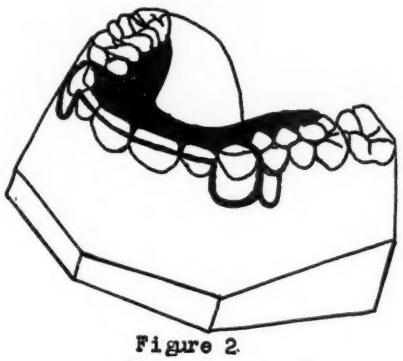


Figure 2

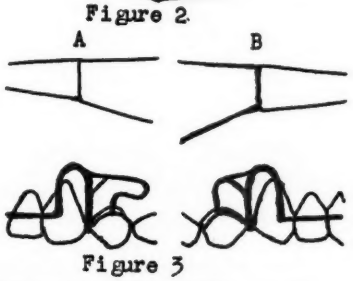


Figure 3

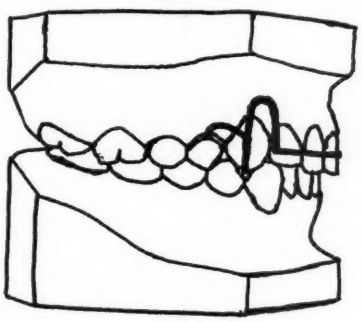


Figure 4

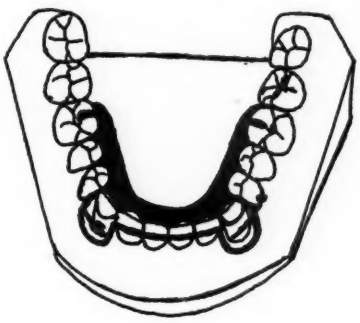


Figure 5

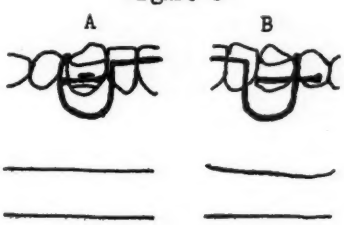


Figure 6

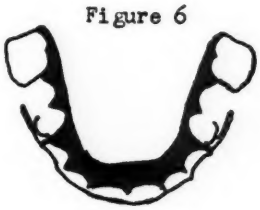


Fig. 1. The upper Hawley removable retainer without any banded teeth.

Fig. 2 *A*. Modified clasp giving more spring with a short wire reenforcing the soldered joint. Fig. 2 *B*. Original clasp with reenforcing wire connecting the crests of the loops.

Clinic presented at the Thirtieth Annual Meeting of the American Society of Orthodontists, St. Louis, Mo., April 21-24, 1930.

Fig. 3. The Hawley retainer as modified by Dr. Lourie J. Porter. The loop comes over the occlusion at a point on the maxillary canine where there is clearance instead of between the maxillary canine and first premolar. This modification has two great advantages: first, it does away with breakage of the wire at the point of entrance into the vulcanite; second, it does away with the settling of the wire between the canine and the first premolar resulting in the formation of a space between the teeth at that point.

Fig. 4. The lower Hawley removable retainer with the canines banded and wire extended from the vulcanite up over the occlusal surface of the first molars in the lingual groove.

Fig. 5. Types of clasps on the lower removable retainer. *A*. Wire soldered to the descending arm of the loop projecting mesially to catch under a cleat which is soldered to the labial surface of the canine band. *B*. Spur soldered to the canine band projecting distally to rest against the first premolar to retain the rotated canine. A step soldered to the descending loop projecting into the embrasure snaps under the canine spur.

Fig. 6. All-gold retainer (after Dr. J. Lowe Young). The wire portion is made up as usual. Pure gold foil is burnished to the lingual surfaces of all the teeth to be included in the retention. The body portion is built up with solder uniting the foil and wire portions. The crib clasps are added to the molars for greater stability.

HIGH LABIAL ARCH

By James W. Ford, D.D.S., Chicago, Ill.

IN PRESENTING a clinic on the high labial arch, two cases which had been treated with this appliance were selected. In the photographs to follow, the various steps are shown in assembling the appliances, demonstrating the uses of the different types of finger springs as used in these cases.

Case 1. Fig. 1. Neutroclusion case, closebite with maxillary anterior teeth spaced. Girl, aged thirteen and one-half years. Treatment was started April, 1928.

Fig. 2. Premolar and first molar maxillary bands in place. A 17-gauge high labial arch is in position, with threaded ends running through horizontal tubes and gold nuts anterior to the tubes. The 22-gauge looped finger springs are inserted into horizontal buccal tubes on the premolars, which serve as stabilizers to the main arch as well as being used for adjustment purposes.

Fig. 3. The 23-gauge central finger springs are shown in place. The parts passing over the incisal surface were flattened with a band contouring pliers.

Fig. 4. The 23-gauge lateral and canine finger springs have been added.

In some cases it may be possible to set the assembled appliances at an early sitting, but with a sensitive patient a similar procedure, as has been shown, is more advisable. The parts may also be added as the various tooth movements are desired.

The arch is tied in the molar tubes with a silk or wire ligature from in front of the nuts on the arch over the distal ends of the tubes or held in place with a lock as shown in Fig. 4. An 0.030 wire is soldered to the ascending portion of the arch, a loop made back of it and the end made parallel to and on the gingival border of the molar tube to lock in a McCoy open tube. The wire should not be bent around the end of the McCoy tube to lock it in place, as the McCoy tube will be distorted, but should be cut off even with the distal and a small wire soldered at right angles to it and cut off even with the buccal border of the McCoy tube. This is an important detail in the technic, as it permits perfect adaptation in the McCoy tube. It has been found simpler to solder the McCoy tube to the molar tube before soldering it to the band. In operation the loop is opened or closed as the nuts are adjusted distally or mesially.

A finer adjustment with less disturbance to the molar anchorage is possible by using the threaded ends with the nuts anterior to the molar tubes.

Clinic presented at the Thirtieth Annual Meeting of the American Society of Orthodontists. St. Louis, Mo., April 21-24, 1931.

The operation of the appliance is quite obvious. The central finger springs, together with the adjustment of the main arch upward, intruded and retruded the centrals. This caused a slight extruding force on the first premolars which was accentuated by slightly opening the loops in the premolar finger springs. It will be noted the lateral and canine finger springs extend well toward the incisal edges, which caused these teeth to intrude as well as retrude as the finger springs were adjusted against them.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

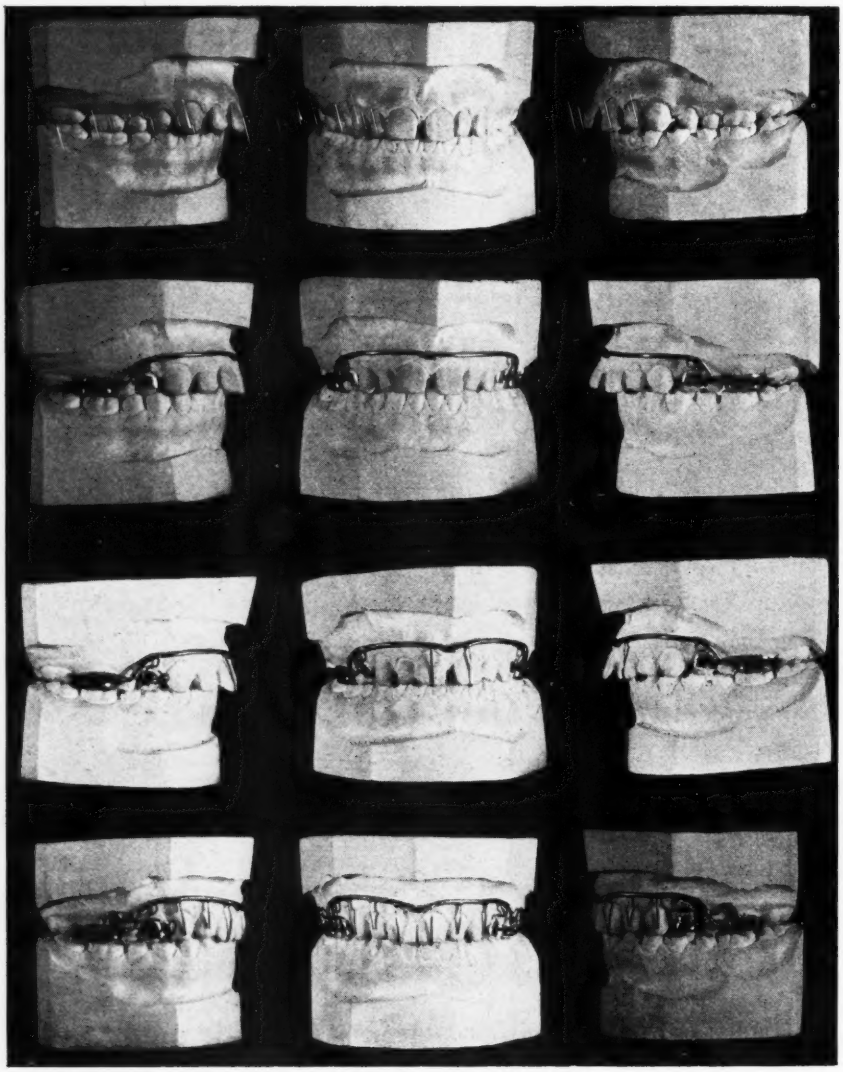


Fig. 5. In March, 1930, it was decided necessary to move the maxillary anterior roots more forward. A soldered lingual arch, as shown in Fig. 5. was placed on the first molars with small gingival extensions soldered to this arch opposite each of the six anterior teeth. This was adjusted with the Lourie wire stretching pliers. It was removed August, 1930.

Fig. 6. November, 1930, all appliances were removed and a Hawley retainer was placed in position.

Fig. 7. Occlusal views of the maxillary arch at the beginning and at the end of treatment.

Case 2. Fig. 8. Neutroclusion case. Central incisors slightly separated and protruded, lateral incisors rotated and quite decidedly protruded and the canines malposed. Girl, aged twelve years, treatment started July, 1928.

Fig. 9. Canine and first molar bands in place with high labial arch in position as described in previous case. The 22-gauge looped finger springs are shown adusted in horizontal tubes on the canines. The horizontal por-

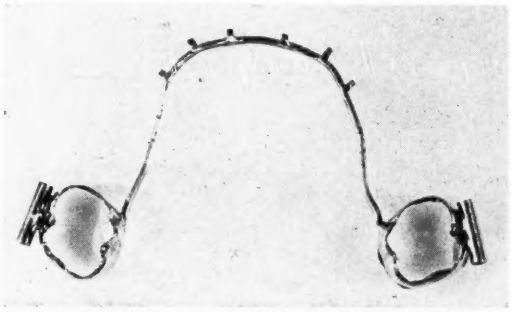
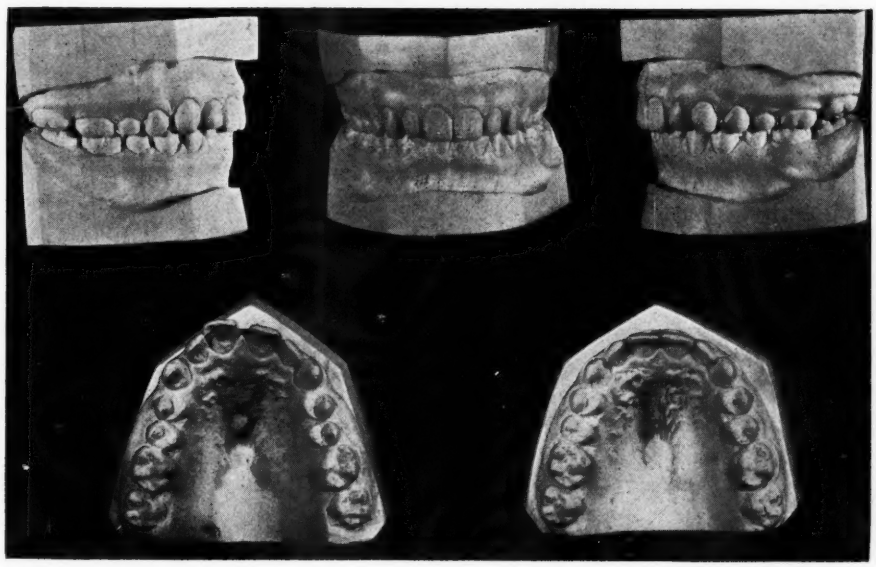


Fig. 5.

Fig. 6.

Fig. 7.



tion is soldered to the main finger spring which extends to the incisal and back to the gingival past the distal end of the tube, locking it in place. This gives all movements desired in the adjustment of the canines. Other forms of finger springs may be designed by the operator to accomplish the same purpose.

It may also be mentioned here that the canine attachments in this case also serve as stabilizers to the main arch as the premolars did in Case 1, as mentioned in Fig. 2. Stabilization on some teeth anterior to the molars is an important consideration in the use of the high labial arch.

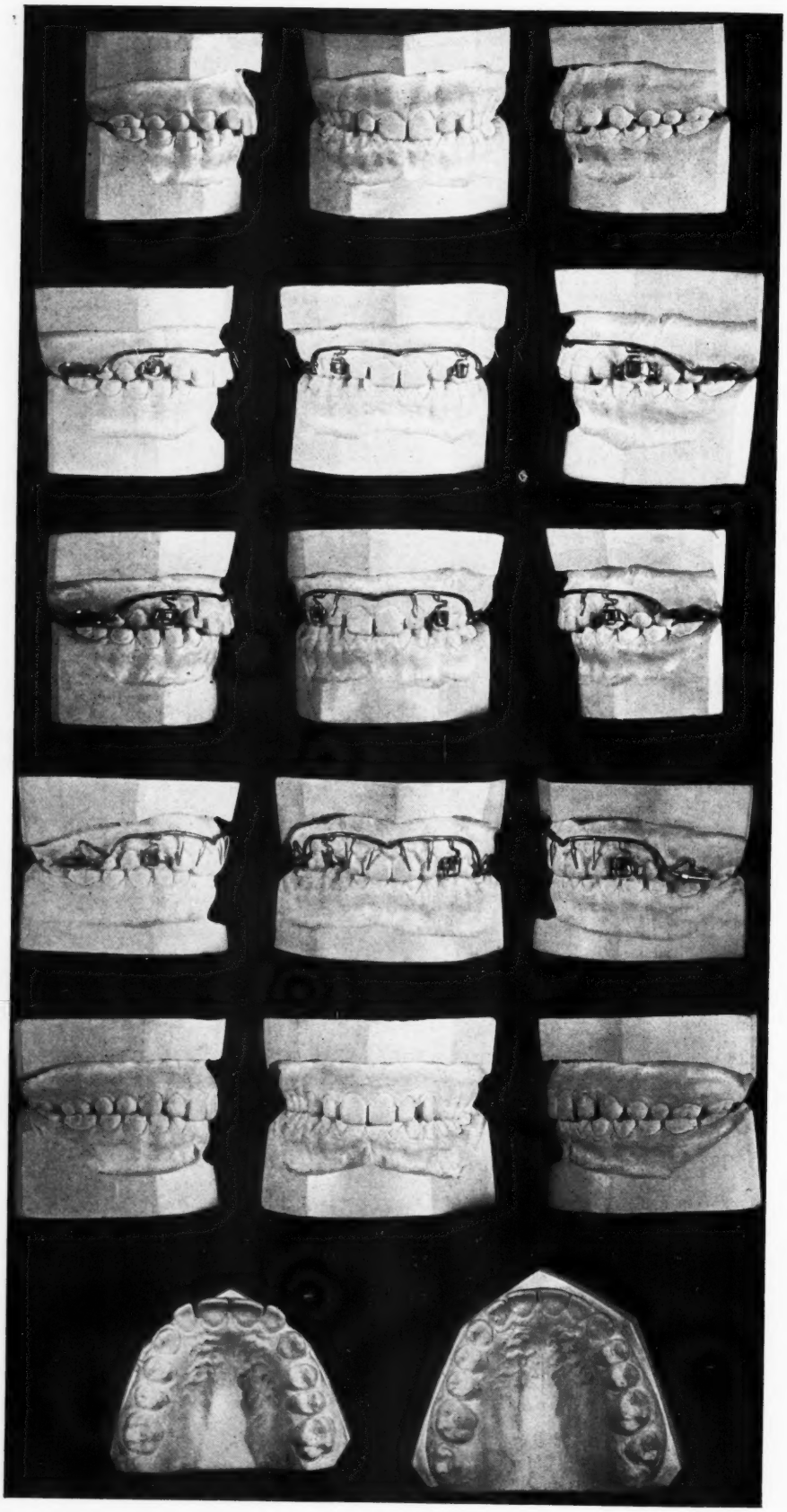


Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 10. The 23-gauge lateral finger springs have been added.

Fig. 11. The 23-gauge central finger springs here shown complete the appliance.

These anterior finger springs are always tapered so that only a point touches the tooth. In this illustration it is shown that the points rest on different parts of the labial surface in order to obtain the desired force. They are also applied toward the incisal surface here to intrude as well as retrude the teeth.

Fig. 12. October, 1929, all appliances were removed and a Hawley retainer was placed in position.

Fig. 13. Occlusal views of maxillary arch at the beginning and at the end of treatment.

ORTHODONTIC NOVELTIES*

DEVISED BY DR. G. KORKHAUS, BONN, GERMANY

HOLDER FOR ORTHODONTIC LIGATURE WIRE

ALTHOUGH on modern orthodontic appliances ligatures are used as little as possible, they cannot always be avoided. In the last years, a special and excellent material has been brought out by the German firm Krupp of Essen, under the name "Wipla-Ligature-Wire."

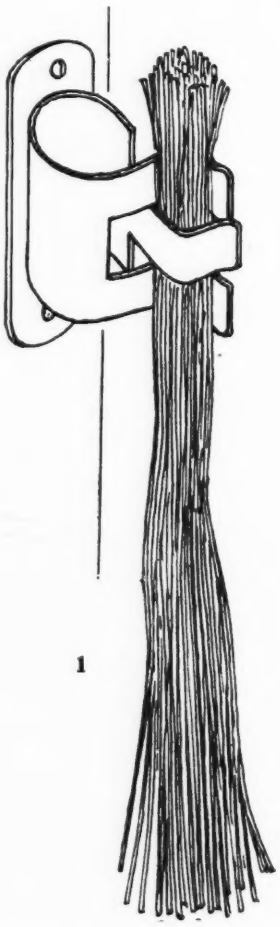


Fig. 1.—Holder for orthodontic ligature wire.

This wire is absolutely free from corrosion, even if it has to remain in the mouth of the patient for some time, and is, in spite of the very small dimensions—0.2 and 0.25 mm.—of an extraordinary stability.

*Transactions of the European Orthodontological Society, 1929.

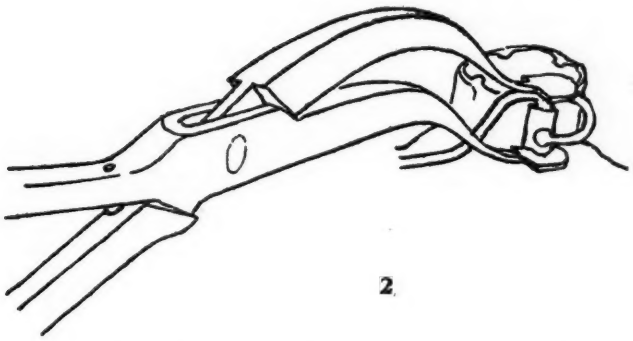


Fig. 2.—Lingual lock pliers for setting in of lingual locks.

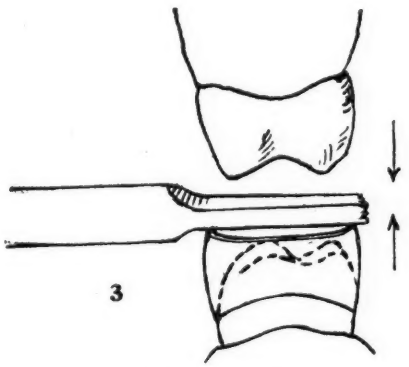


Fig. 3.—Band-setting instrument.

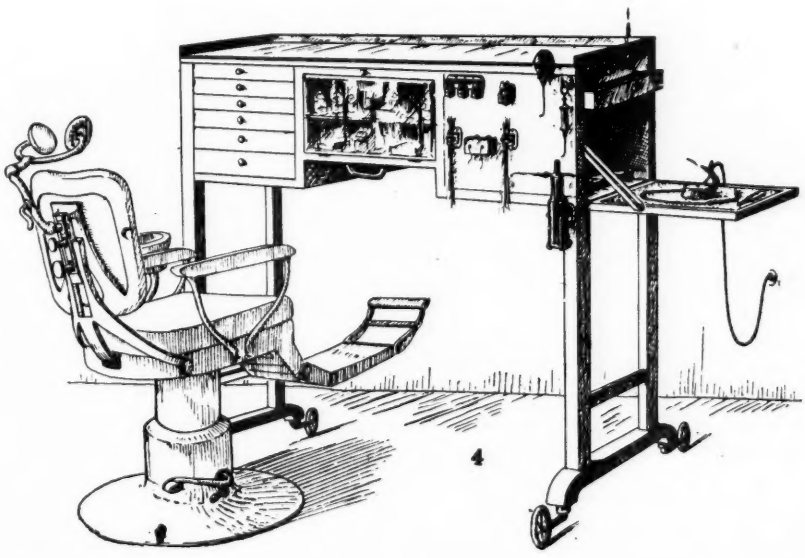


Fig. 4.—Orthodontic table for instruments, suitable for doing repairs and alterations in the presence of the patient.

In order to facilitate the use of this wire, I have designed a holder (Fig. 1) from which wires can be taken out, without disturbing those remaining in the bundles, until the last remaining one is used.

LINGUAL LOCK PLIERS

When placing the mandibular lingual arch in position in the mouth, difficulties are sometimes experienced, especially when the mandibular molars are tilted inward. In these cases the use of the lingual lock pliers (Fig. 2) is recommended. These pliers permit the pressing in of the pins of the lock into the tubes, and this without damaging the lock; furthermore, these pliers are of such a shape that they can be used for both sides.

BAND-SETTING INSTRUMENT

When fitting and placing orthodontic bands in the mouth, a small wooden instrument is a welcome and well-known help (Fig. 3). It permits the ring to slip over the tooth, with the help of the pressure of the opposing tooth, and offers with the help of its grooved end the possibility of adapting the band to the chewing surface.

ORTHODONTIC INSTRUMENT CABINET

For the practitioner who is often engaged in orthodontic work, I have designed this cabinet (Fig. 4), which permits of all instruments and orthodontic materials being conveniently arranged. It contains shallow drawers —on the left—for all the necessary instruments such as pliers, scissors, etc., in the center, materials and medicaments, and—on the right—rubber rings, silk, ligature wire, etc., all that is needed for orthodontic work. On the right-hand side, a small table for soldering, which must often be done in the presence of the patient. Drawers, which can be reached from the side, contain the essential technical instruments and the soldering lamp. On the left-hand side is a corresponding small cupboard for impression trays. The cabinet is placed over the chair when the orthodontic consulting times begin. On top, the cabinet is covered with a glass plate and gives ample room for the placing of instruments.

This table and the above-mentioned instruments can be obtained through the firm Seitz & Haag, Frankfurt a/Main, Rossmarkt 15.

DEPARTMENT OF
ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA

Under Editorial Supervision of
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THE NASAL ACCESSORY SINUSES AND THEIR RELATION TO DENTISTRY

By Richard L. Bower, M.D., D.D.S., F.A.C.S., Kansas City, Mo.

IT IS not the purpose in this paper to give a detailed account of the anatomy of the nasal accessory sinuses. Nevertheless, a few introductory remarks as to the location and openings of the various sinuses may not be amiss. I shall, for convenience, group the three upper sinuses, namely; the frontals, ethmoids and sphenoids, and shall devote the greater part of my remarks to the lower sinus, the maxillary or antrum of Highmore which is of especial interest to dentists, at least it should be.

The frontal sinus, lying in the ascending ramus of the frontal bone, takes the shape of a pyramid with the base lying inferiorly. The shape may be regular, but it is usually extremely inclined to the opposite, assuming all sorts of fantastic forms and directions, depending upon the amount of reabsorption the bone has undergone. It is apparently quite independent of its fellow of the opposite side, as one may be fully developed while the opposite side practically fails to develop. Indeed the two sides are never exactly similar. The left side is usually larger than the right. The two sinuses are separated by a bony septum which may be considered as a direct upward extension of the nasal septum. The opening of the frontal sinus may empty directly into the nose or into an enclosed duct which leads into the nose. In either case, however, it opens into the middle meatus.

The ethmoid sinus, as a rule, consists of nine or ten cells contained in the ethmoid bone and is divided into two groups of cells, the anterior, six to eight in number, opening into the middle meatus of the nose between the inferior and middle turbinates; and the posterior, two or three in number, opening into the superior meatus.

The sphenoid sinus occupies the body of the sphenoid bone directly behind the posterior ethmoid cells. The sinuses are separated from one another by a partition which, like that of the frontal sinus, may be considered as a continuation of the nasal septum. The sphenoid opens into the superior meatus of the nose between the superior and middle turbinates.

These three upper sinuses are in immediate relationship with the brain and orbit; hence the frequency with which serious complications are met. They are all lined with mucous membrane resembling closely the nasal mucous membrane, except that in the sinuses, mucous glands are not so numerous.

The diagnosis of affections of these upper sinuses, in the acute stage, depends upon the symptoms, such as a pain over the frontal region, between the eyes, or sometimes in the occipital region, especially when the sphenoid is affected. The pain as a rule is noted in the morning upon awaking, as the recumbent position does not favor drainage. The pain increases in severity for the first hour or two when the patient is up and about, and then gradually recedes as drainage from the sinuses is facilitated by the upright position. Upon nasal examination a discharge is seen corresponding to the openings of the sinus or sinuses affected, for it must be remembered that often several sinuses are involved. X-ray pictures and transillumination are generally of assistance in the diagnosis. In the chronic cases the symptoms may be very puzzling, especially the location of the pain or headache. The diagnosis is made chiefly upon the transillumination and x-ray findings, together with the intranasal examination and history of a chronic nasal or postnasal discharge.

Treatment in the acute stages consists of nasal shrinkage, suction, and the application of dry heat, together with supportive measures. In the chronic cases we may attempt to open and drain the sinuses by an intranasal operation or, in the case of the frontal and ethmoids, we may do a radical operation if we think it necessary.

So much for a very brief description of the upper sinuses. Coming to the maxillary sinus or antrum, with which, as dentists, we are intimately concerned, let me impress upon you the direct relationship the teeth bear to this cavity. The antrum may be likened to a pyramid with the lateral wall of the nose forming the base, the apex being at the junction of the malar bone with the superior maxillary. This would give us three sides; namely, a superior, an anterior, and a posterior and a base. The superior wall is the floor of the orbit; the posterior wall limits the pterygomaxillary fossa, and the anterior is the wall of the canine fossa. The alveolar process of the superior maxilla forms the inferior border of the fossa (really the floor of the antrum), which is formed by the junction of the anterior wall and the base (or lateral nasal wall).

The normal capacity of an adult antrum is about one-half ounce.

Running in the substance of the superior wall of the antrum, we have the infraorbital canal, and through the anterior wall or wall of the canine fossa are the canals carrying the nerves supplying the maxillary teeth. In general the relation of the roots of the teeth to the antrum is as follows: the floor of the normal maxillary sinus extends from the first premolar to the third molar.

As the floor of the sinus does not run parallel with the alveolar process but is strongly curved above, it naturally follows that the roots of one or two teeth must come in closer proximity to the floor than those situated at the extremities of the sinus. These teeth as a rule are the second premolar and the first molar, although in this connection it may be stated that when Nathaniel Highmore first opened the antrum bearing his name, two hundred and seventy-five years ago, he extracted the canine in order to make the opening.

The antrum is lined with ciliated epithelium, the cilia setting up a current toward the opening of the sinus which is in the middle meatus. As will be seen, this opening is very poorly placed to be of service when we are in the upright position, being near the highest part of the sinus and not allowing the free escape of contained fluid, which is accomplished in a great measure by the action of the cilia.

Fig. 1.—Posterior view of vertical transverse section of head showing large maxillary sinuses. The floor of the right maxillary sinus is enclosed between the lingual and buccal roots of the first molar.

A cord is seen marking the natural opening of the maxillary sinus on either side, showing how poorly this opening is located, as far as sinus drainage is concerned. (After Cryer.)

The distances between the apical portions of the roots of the teeth and the floor of the sinus are inconstant in different individuals, depending upon the amount of cancellated bone structure which intervenes. Certain specimens show the distance separating these structures to be several millimeters while in others the roots project distinctly into the sinus. In the latter instance the sinus mucosa alone separates the root from the cavity proper. The interior of the maxillary sinus is not always smooth, but quite often presents partial septa which are usually situated on the floor and in the superior internal angle.

In order to diagnose a diseased antrum, it is of course necessary to have a clear understanding of the various causes that may produce the condition. The antrum is more often diseased than its fellow sinuses because it has one more etiologic factor, namely, the intimate relation of its floor to the roots of the teeth. It will be remembered that the nasal sinuses are usually affected through their openings, occasionally through the circulatory system. Not

only does the maxillary sinus present this to a marked degree on account of the extremely unfavorable situation of the ostium, but, in addition, certain affections of the alveolus are prone to affect this cavity. Direct extension from the nasal mucosa is the most frequent cause of maxillary sinusitis. In all cases of acute coryza there is bound to be more or less inflammation of the maxillary sinus. When general resolution sets in, the sinus membrane also regenerates, and it is only in those cases where the drainage is seriously interfered with that the disease becomes chronic. We can readily see how easily this can occur, especially in the maxillary sinus where the opening is situated so high and the middle turbinate, when swollen, may occlude it.

Generalized infections may affect the antrum through the circulatory system. The most important of this group is influenza, but the precise reason why this disease shows such a marked predisposition to affect the sinuses as

Fig. 2.—Another view of a transverse section of a head showing the close relationship of the first molar roots to the maxillary sinus. Also showing a septum in the floor of either sinus. (After Cryer.)

well as the mode of infection must for the present remain unanswered. Contamination from the upper group of sinuses, especially the frontal and anterior ethmoids, may readily infect the antrum, inasmuch as secretions from these sinuses may, by dependent drainage, pass from their openings in the hiatus semilunaris directly into the opening of the antrum. Again, sinus suppuration may be occasioned by the action of foreign bodies which have found their way into the antrum. The mode of ingress may occur in three ways: first, through the natural opening, as for instance, blood and vomited material; second, through the osseous walls, with injury to the mucosa; and, third, through an artificial opening in the alveolus and the pushing of a tooth or root into the antrum. When a foreign body enters the antrum, it must be either infected or irritating to the lining mucosa in order to cause an immediate empyema. We, as dentists, are especially concerned with the oral and

dental factors in causing antral disease, and the following factors may be mentioned: first, involvement of the antrum in the extraction of a tooth whose apex entered the antrum; second, root therapy on a tooth, the apex of which enters the antrum; third, involvement of the antrum in the removal of closely situated, impacted, unerupted, malposed and supernumerary teeth; fourth, surgical removal of teeth, particularly when the roots are extracted by the removal of the whole buccal plate; fifth, a group of pathologic processes including acute and chronic dentoalveolar abscesses, cysts, necrosis and osteomyelitis; sixth, trauma and fractures of the maxilla; seventh, interstitial gingivitis; eighth, neoplasms of dental and oral origin; and, ninth, the mouth lesions of such diseases as syphilis, tuberculosis and actinomycosis.

It was formerly thought that every case of antral empyema or suppuration was directly due to dental infection. This opinion has gradually changed

Fig. 3.—A posterior view of a transverse section through a head showing on the right side, the lingual root of the first molar forming a distinct projection in the floor of the maxillary sinus. (After Cryer.)

until now the proportion is placed at approximately 25 per cent. How important this fact is to us may be gathered from the knowledge that the antrum is by far the most common of all the sinuses affected, and one out of every four cases is due directly to intraoral causes.

How can an antral empyema of dental origin be distinguished from that of nasal origin? There are four distinct points of difference: first, the presence of, or history of, suppuration in connection with certain teeth; second, suppuration of dental origin is limited to the antrum and is usually unilateral, with the absence of other sinus suppuration, for while polypi often accompany antral disease of nasal origin, it is very unusual to see polypi in antral suppuration of dental origin; third, the dental antrum contains, as a rule, grayish foul pus, smelling strongly of Bacillus coli, with a sandy deposit, while pus from a nasal antrum is creamy, stringy, mucopus of musty odor; and, fourth, x-ray pictures of the roots of the teeth will sometimes show the extension of

disease to the antrum. It should, however, be remembered when reading an x-ray picture of the teeth that a small shadow around the root does not necessarily mean that the dental condition is negligible, because in cases where the roots are protruding into the maxillary sinus there is not enough bone to allow the formation of a large abscess cavity. These cases with little indication of bone destruction are more liable to cause sinus infection than those with an extensive abscess cavity well removed from the sinus. In order to diagnose maxillary sinus infection some orderly routine is necessary, such as the following; the clinical history leads toward a suspicion of antral involvement. Such symptoms may include a feeling of distention and pressure over the antral region. There may be pain either over the antrum or above and between the eyes. There may be headache which is usually intensified by stooping, coughing and sneezing, and there is usually a nasal discharge which is most profuse in cases of dental origin. Next, palpation of the area over the antrum will often reveal a tenderness, likewise the maxillary teeth on

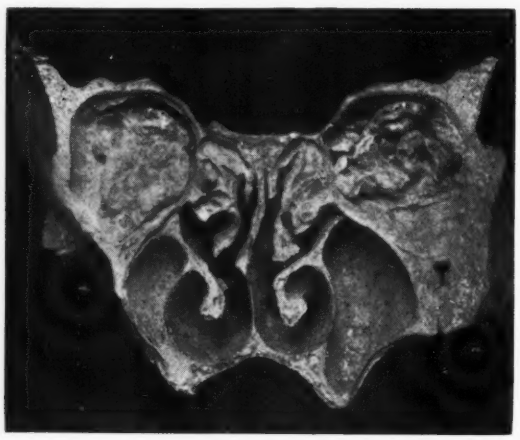

Fig. 4.—Anterior view of a transverse section through a head, showing that on the right side, an opening made through the alveolar process in order to drain the maxillary sinus, would instead perforate the floor of the nose. (After Cryer.)

the affected side. The clinical findings within the nose include congestion and turgescense of the soft structures and the presence of pus. If no secretion is present in the nose, the use of suction will often be found to be quite helpful. By transillumination of the antrums one finds the affected one to be dark, depending somewhat upon the extent of the involvement. The x-ray picture will corroborate the above findings. This x-ray picture in many cases should include the teeth as well as the antrums. Last, the antrum may, with very little discomfort to the patient, be punctured beneath the lower turbinate and washed; which, to my mind, is the most satisfactory of all our aids to diagnosis. Naturally, you may claim that alveolar puncture, opening through a tooth socket, is a simple, easy procedure, as it opens into the lowest point of the antrum and should be the best drain. But in actual practice it is disappointing, because the mucosa at the antral orifice of the puncture becomes edematous and forms a ball valve; the cilia of the mucosa also wave toward the upper part of the antrum to its ostium and away from the alveolus. Then,

too, this drain is like the neck of an inverted bottle, and reinfection from the mouth is very liable to occur. All of us have, however, accidentally opened the antrum in the removal of a tooth or root. If we have not meddled too much with the opening, meaning by that if we have not attempted to push a great wad of packing into the opening, nor attempted to syringe with a peroxide solution, nor curetted, the opening readily closes with no ill effects.

Thus having established our diagnosis of antrum infection, and having decided whether or not the case is acute or chronic, we can proceed to the treatment. Before starting any treatment it is always my custom to satisfy myself whether or not the case is of dental origin. The teeth are examined and if they are at all suspicious, consultation with the patient's dentist is requested, and an attempt is made to put the mouth in as healthy a condition as possible. Oftentimes this of itself will clear up the antral infection.

There are in general four methods of treatment of maxillary sinus disease. In an acute case we may shrink the nasal mucosa, especially the area of the antral opening, using 0.5 per cent solution of cocaine with ten drops of adrenalin added to the ounce of solution, and then apply dry heat or suction, or both, or we may cocainize the region beneath the inferior turbinate, and insert a trocar and cannula and wash the antrum with a normal salt solution. In the great majority of acute cases, these methods will clear up the infection. If, however, we are dealing with a chronic case, we can first try washing the antrum and, if after repeated washings, say eight or ten, the condition remains stationary, we are obliged to use other methods. An opening may be made into the antrum through the nose under the inferior turbinate, large enough to admit a finger, and the patient can be instructed in the method of syringing the antrum, and can carry on the treatment at home. This measure failing to cure the condition, due most probably to a polypoid degeneration of the antral mucosa, we can employ one of the radical antrum operations, of which the Caldwell-Luc is the most widely adopted. Here, under general or local anesthesia, local preferably, an opening is made into the antrum through the canine fossa, the interior inspected, and degenerated mucosa lightly curetted to remove all polypoid material, and then an opening made into the nose, resecting a portion of the inferior turbinate. The antrum is lightly packed with iodoform gauze with the free end protruding into the nose, and the opening in the canine fossa closed with sutures. The gauze is removed through the nose in two or three days and subsequent treatments, such as syringing are also made through the nasal opening.

In the practice of exodontia, there will be accidents to the antrum, either an opening made into the antrum or a root or roots will be pushed into the antrum. In the first instance, where only an opening has been made during an extraction, I should not attempt to curette the cavity, but should endeavor to approximate the tissues as much as possible and insert a small piece of iodoform gauze in the opening, if necessary putting a stitch through the soft tissues and including the gauze, so it will not be displaced. This should be changed daily, putting less gauze in the opening each time, and the probabilities are that the opening will readily close with no ill effects. As a rule the iodoform gauze

can be dispensed with in five or six days. Frequent use of a mouth wash is advised, for its mechanical cleansing effect and to reduce the bacteria of the mouth to a minimum.

If, on the other hand, during an extraction, a root is pushed into the antrum, it is well to face the music at once and not try temporizing measures for some time, when the patient is as a rule, in no mood to have anything further done. I have had little success in removing a root through the socket, with various probes or tweezers, although this can be tried. If the portion of root is very small, the opening through the socket into the antrum may be somewhat enlarged and quarter inch iodoform gauze can be introduced into the sinus in the hope that the root fragment may become entangled in the gauze and so removed. Another method that sometimes is successful consists in enlarging the antral opening and with the patient's head bent forward irrigating the antrum through the socket, always remembering that the root fragment may be forced into the nose with the further possibility of its being aspirated. If these simpler measures do not suffice for the removal of the root, I should make an opening into the sinus through the canine fossa and then with proper illumination, it is possible to see the root and remove it. The canine opening is to be sutured, of course, following the removal, and the socket opening packed lightly with iodoform gauze and treated as before stated. If an opening persists in the mouth leading into the antrum, some plastic operation should be done in the mouth and the opening closed and further treatment carried out through the nose.

It is to be remembered that inflammatory diseases of the antrum proper do not cause swelling or bulging of this sinus. Such a condition usually is the result of a cyst or tumor of the antrum. Cysts of the antrum are as a rule either follicular cysts, developing from the root follicle (cells of Melassez) or dentigerous cysts, the result of degeneration of a root granuloma. Their diagnosis is based on the slow, painless growth, a crackling feeling on palpation, and x-ray findings. Often these cysts will cause a pronounced bulging of the antral region and especially of the corresponding half of the hard palate. Treatment is by surgical removal and the same is true of antral tumors such as carcinoma, where radium is also of value.

Thus, in general, I have attempted to present the diagnosis and treatment of sinus disease, especially that of the maxillary sinus, hoping, at least, to have made clear the close relationship which I believe exists between the dentist and physician in the management of these cases.

SURGICAL CASE HISTORIES—IMPACTED AND UNERUPTED TEETH

By Bennett A. Field, D.D.S., New York, N. Y.

CASE 1. Figs. 1 and 2. Female, eighty-three years of age, presented with extensive swelling of the left side of the face. Clinical examination revealed an intraoral fistula discharging pus in the left mandibular first molar region. The mandible was edentulous. A history of previous acute attacks was elicited. For a long time a marked rigidity of the submaxillary tissues had been observed.

Fig. 1.

Extraoral roentgenographic examination revealed presence of impacted and unerupted left mandibular first molar. About the crown of the unerupted tooth was evidence of a degenerated follicular sac. (A small cystic area in the premolar region may be observed in Fig. 1. This cyst is unrelated to the acute symptoms.) Note the complete disintegration of the crown of the tooth. After consultation with the family physician, it was decided to operate for the removal of this tooth as soon as the acute symptoms had subsided. On operating, the roots were found deeply embedded, fused, with a marked L-shaped curvature.

Fig. 2 shows the immediate postoperative result. Note the thin layer of bone at the lower border of the mandible. Recovery was uneventful, the rigidity completely disappearing after the removal of the tooth.

Fig. 2.

Fig. 3. Fig. 4.

Case 2. Figs. 3 and 4. Male, aged twenty-one years. Presented with extensive swelling of the face and edema of the tissues under the right eye. Roentgenographic examination revealed presence of impacted and unerupted right maxillary canine. There was a history of dizziness, nausea and vomiting, with temporary blindness at periodic intervals of ten days or two weeks ever since childhood. On operating, the tooth was found deeply embedded labially, extending from the apex of the right maxillary lateral upward and

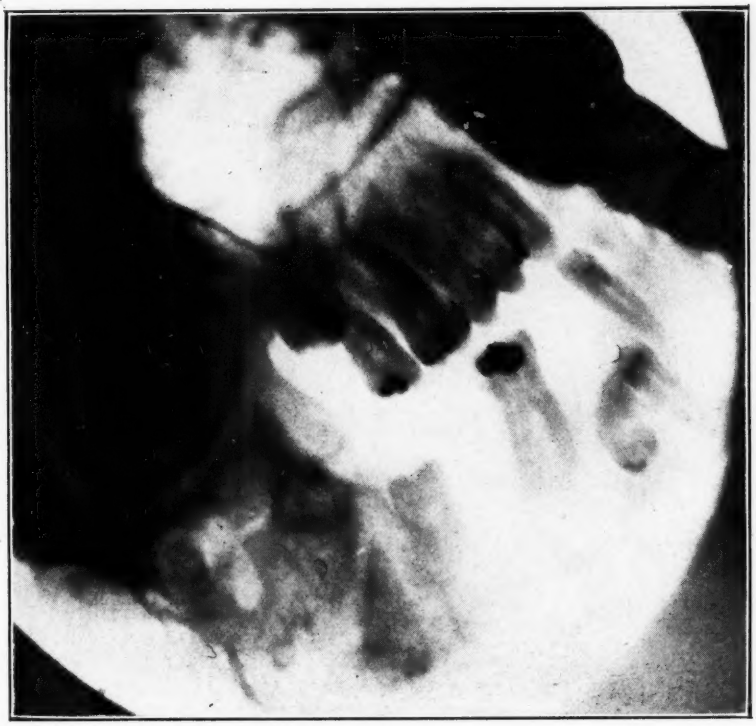

Fig. 5.—Impacted left maxillary and mandibular third molars and two premolars. The second premolar is completely inverted.

Fig. 6.—Postoperative.

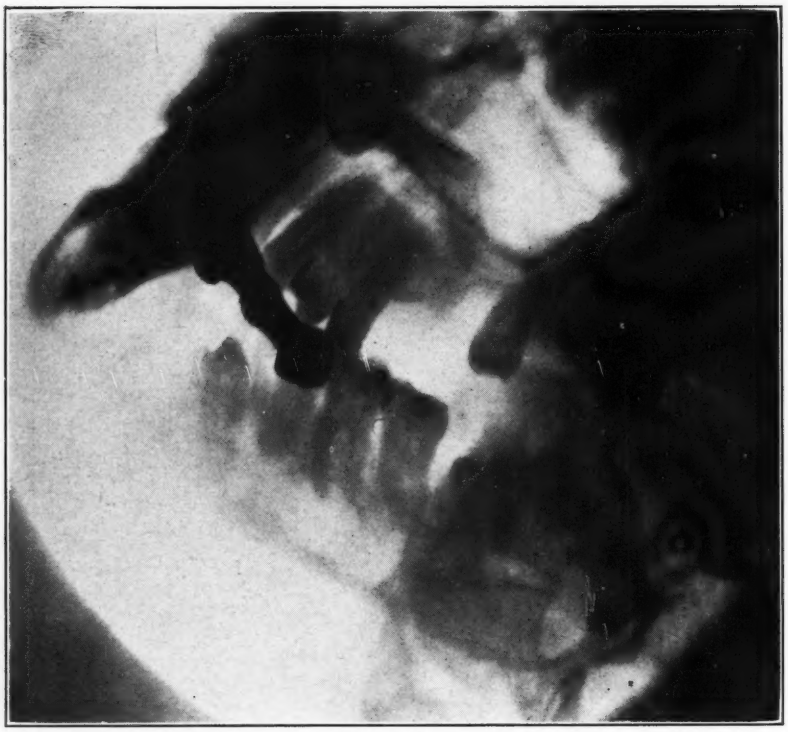

Fig. 7.—Impacted right mandibular third molar and first premolar.

Fig. 8.—Postoperative.

backward into the maxillary sinus. Although considerable time has elapsed since the operation was performed, there has been no recurrence of the symptoms described above.

CASE 3.—Showing a series of six impacted and unerupted teeth.

The foregoing cases are reported both for their general interest and for the object lesson they point. It is my contention that impacted teeth are at all times a source of potential disturbance both locally and constitutionally. They should be either brought into normal occlusion, if feasible, or operated upon for removal.

745 FIFTH AVENUE.

ABSTRACT OF
CURRENT LITERATURE

NUTRITION AND PEDIATRICS

By Samuel Adams Cohen, M.D., New York City

It is the purpose of this Journal to review so far as possible the most important literature as it appears in English and foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

Observations on Epidemic Catarrhal Jaundice. G. M. Findlay, J. L. Dunlop, and H. C. Brown. Tr. Royal Soc. Tropical Med. & Hygiene **25**: 1, 1931.

In a classical article Findlay, Dunlop and Brown relate some of their observations concerning epidemic catarrhal jaundice. Although epidemics of jaundice have been recorded since the time of Hippocrates, the writers, in reviewing the literature, find no convincing evidence that all these outbreaks associated with the occurrence of jaundice are one and the same disease.

During the past year these authors studied 140 cases of jaundice in Surrey County, London. Because of its marked prevalence in that section the writers feel that it is more correct to refer to the disease as being endemic rather than epidemic. In regard to the occurrence of its epidemic nature the disease has a seasonal incidence, and this usually occurs in the late autumn and winter. According to the authors' statistics 80.6 per cent of the infections occurred in children, and this figure is in accord with a vast majority of similar statistics in literature.

The authors who report this study from the Wellcome Bureau of Scientific Research, London, state that there is a strong suggestion that the disease is conveyed by droplet infection from the nasopharanx. Their experience of a three to five week incubation period is in accord with many other observers. Laboratory investigations have so far failed to throw any light on the etiology of this condition.

The clinical symptoms are as a rule mild general lassitude, suffusion of the face, pain over the region of the liver, and vomiting. The temperature which varied from 101° to 102° subsides in three or four days. Jaundice and clay colored stools usually appear from three to seven days after the onset of the disease, although these two predominating symptoms may be delayed as long as three weeks. While headache of the frontal type was commonly noted, catarrh of the nasopharanx was not a frequent occurrence. Nosebleeds were not uncommon, although there were no other evidences of hemorrhages. In the present series the authors report no deaths, and they state that there is evidence that one attack leads to a certain amount of immunity.

The differential diagnosis from a similar but a much more serious condition which is caused by *Leptospira icterohemorrhagia* (commonly called Weil's

disease) is to be made from a differential blood count. When the disease of epidemic catarrhal jaundice is well established, there is an absence of a relative increase of polymorphonuclear leucocytosis and an increase in large amount of mononuclear and transitional lymphocytic cells. However, it must be borne in mind that this disease, commonly termed infective hepatic jaundice, or as it is sometimes termed epidemic catarrhal jaundice, can only be definitely distinguished from leptospiral jaundice by the absence of pathogenic leptospira in the blood and also in the urine, and moreover by the failure to develop antibodies against leptospira.

Because of the characteristic behavior of epidemic catarrhal jaundice—long incubation period, characteristic blood picture and difficulty of transmitting the disease to a lower animal—the authors hold that all this suggests the possibility of a virus origin for the disease.

Studies on Infantile Beriberi Based on Five Hundred Fourteen Cases. José Albert. Philippine J. Sc. **45**: 2, 1931.

Professor Albert of the Department of Pediatrics, University of the Philippines, states that infantile beriberi, which differs from adult beriberi in almost every particular, is one of the most important infant diseases to the Philippine practitioner. Although adult beriberi was known to the Romans as early as 24 B.C., it remained for the Japanese physician Hirota to note a peculiar symptom complex of vomiting, incessant crying, dyspnea, edema, increased heart rate, which occurred only in the breast-fed child (nursing of course from mothers having adult beriberi), and he presented thirty such cases in Tokyo in April, 1891.

Infantile beriberi or Philippine "taong" was first discussed in the Philippines in 1904 by the late and eminent Manuel Guerrero. Later Chamberlain and Vedder who were certain that beriberi was due to a deficiency, and whose cases of infantile beriberi were treated by administering the extract of rice polishings directly to the infants. As a result, there was a dramatic and immediate cessation of symptoms, and from that time, 1912, to the present, infantile beriberi has been becoming rarer every day.

In regard to its etiology, Albert observes that beriberi is seen more often during the rainy season than during the dry season and it is seen much more frequently in densely inhabited urban sections in the Philippines. In contrast with rickets and scurvy, it is interesting to note that in infantile beriberi, the younger the child the more frequent and the more severe is the disease. Congenital beriberi occurred four times in Albert's series of five hundred and fourteen cases.

Infantile beriberi occurs very exceptionally among the rich and middle classes and is strikingly a disease of poverty. That is to say poverty brings with it partial starvation, and of necessity nursing mothers in such straitened circumstances generally indulge in a monotonous diet consisting mostly of dried fish, an excessive amount of rice, and a scant amount of vegetables. According to McCarrison this diet has an excess of starch and lacks an adequate amount

of protein, moreover it can be readily seen that this diet is deficient in certain minerals, for example, calcium, sodium and chlorine besides being deficient in vitamins A and B.

It must be borne in mind that infantile beriberi occurs exclusively in breast-fed infants, and curiously enough the severity of the symptoms has no direct relation to the severity of the symptom complex of adult beriberi of the mother. As a matter of fact about 25 per cent of the nursing mothers had what might be termed symptomless beriberi. Paradoxically the duration of breast feeding bore no relation to the severity of symptoms in the infant.

Albert states that based on experimental and clinical observations infantile beriberi is a true deficiency disease, in that the breast milk of mothers with bereberi lacks vitamin B, a "harmone food" or "functional food" which is indispensable to the presentation of a proper "internal medium" and normal physicochemical metabolism.

Asymmetry of the Head and Face in Infants and Children. David Greene. Am. J. Dis. Child. **41**: 6, 1931.

In an interesting article Greene tells of his observations on the asymmetry of the head and the face in infants and children who are residents at the Home for Hebrew Infants, New York. The author attributes the changes of the infant's head and later of the face to its recumbent position. The deformity which results presents certain characteristics and these include: (1) a flattening of the occipital region, usually the right with bulging of the frontal region on the same side; (2) a prominence of one cheek, usually the right which involves the malar bone while the opposite cheek appears flattened; (3) sometimes irregularity of the dental arches.

Greene argues that since this asymmetry of the face and the head came about by a fixed position in the crib he holds that by changing the infant's sleeping posture to the opposite position there would be much more symmetry to the shape of the head and face. And so he used such simple mechanical devices as, for instance, a sand bag or he provided the infant with caps on which strings were tied to the lattices of the crib. Naturally as a result the infant was prevented from rolling its head back to its accustomed sleeping position.

After a few weeks' trial with these devices Greene found that these simple measures were adequate to correct the deformity.

In studying these cases this investigator believes that the softening of the bone of the head is merely a part of the symptom complex which includes softening of the ribs as well as softening of some of the long bones of the body. The deformity of the occiput seems to be due to the almost constant pressure on the osteoporotic bones resulting from posture. Greene is of the opinion that because this deformity frequently persists into childhood and is sometimes even permanent, preventive measures with these babies are well worth while, and in the main this consists merely of changing the posture of the infant so that the pressure falls on the opposite side of the head.

Present Conception of the Relation of Diet to Health and Disease. C. J. Barborka. Proc. Staff Meetings Mayo Clinic **6**: 31, 1931.

Writing from The Mayo Clinic, Division of Medicine, Barborka discusses some phases of the physiology and the psychology of foods. He mentions the fact that the many food fakers, faddists and pseudo-scientists have taken advantage of the laymen's sentiment and prejudice in regard to their daily food intake.

The author states that probably 80 per cent of the adult patients who consult the average physician are interested in a diet from the standpoint of preventive medicine. In this respect he outlines the principles of a protected diet for maintaining health, which includes: (1) adequate protein, (2) sufficient calories for energy requirements, (3) minerals, (4) vitamins. He considers that one gram of protein for each kilogram (2.2 lb.) of body weight is adequate for the average normal adult.

In commenting on the American dietary Barborka emphasizes that it is more deficient in calcium than in any other minerals. A daily requirement of approximately 0.75 to 1 gram (15 grains) is the amount contained in about a quart of milk. The author also feels that the average diet of adults usually does not fulfill the adult daily phosphorous requirements of 15 or 20 grains a day. However, he feels that the ordinary diet is not deficient in the daily requirements of iron, which is about 15 mg. of iron.

According to Barborka the following may serve as a basis adequately to cover the principles of protective diet for maintaining health in the adult: Daily intake of a pint of milk, one egg, three servings of vegetables besides potatoes (one a green leafy vegetable), two servings of fruit (one raw), meat, fish or fowl (one serving about 2 oz.), a tablespoonful of butter.

With these foods serving as a nucleus for the daily diet, additional articles of food may be taken to add to the caloric value in order to maintain body weight.

Barborka sounds a timely note of warning when he states that perhaps the greatest fault of dietetic therapeusis today is the attempt to use as a routine a stock or printed list for a particular disease, irrespective of the particular needs of the individual patient.

In commenting on the success or failure of diets the author makes the pertinent remark that success in dietary therapeutics cannot be obtained by any patient who merely attempts a few weeks of enthusiastic effort on a particular diet and then returns to his old habits of daily food intake.

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EDITORIAL

Dental Clinics

DURING the past twenty years, certain philanthropists and groups of social workers have founded, or planned the formation of, various types of dental clinics. Some of these clinics have been designed for the purpose of providing dental service to children whose parents are unable to supply them with dental service. The most outstanding of these clinics which have been in operation for a number of years, are the Forsythe Infirmary of Boston and the Eastman Infirmary of Rochester. The advocates of these infirmaries have contended that if dental service was rendered to children, the children would act as missionaries in spreading the gospel of dental health to their parents.

It is also believed that these children who receive dental service at the clinic would appreciate dental care, and consequently, would take care of their teeth during adult life.

The Forsythe Infirmary and the Eastman Infirmary have been in operation long enough so that if the above-mentioned arguments are correct, some facts should be available to substantiate them. We have seen no such results.

During the last few days, a letter was addressed to Dr. Percy Howe, Director of the Forsythe Infirmary, by a prominent New York dentist, calling his attention to this matter and asking if it would not be possible for the Forsythe Infirmary to make a research for the purpose of answering the points referred to in the previous part of this editorial.

Recently, certain foundations have taken up the question of establishing dental clinics. A great many of these activities have been carried on by misguided, enthusiastic social workers who do not have the proper conception of the relation of dental care to the individual.

One of the most noticeable gestures in regard to the establishment of a dental clinic was made by the trustees of the Rosenwald Fund to the Chicago Dental Society, the object of which was the establishment of a low fee dental clinic, to have the guidance and direction of the Chicago Dental Society. In a recent letter to the secretary of the Chicago Dental Society, the offer has been withdrawn. The closing paragraph reads as follows: "The Rosenwald Fund has for one of its objectives the development of health service for people of moderate income, and in the dental aspects, we had hoped to have the guidance and direction of the Chicago Dental Society."

It appears to me that the Rosenwald Fund had exactly received what it wished. The Chicago Dental Society decided that the establishment of a low fee dental clinic would be to the detriment of the public.

However, it is very probable that the trustees of the Rosenwald Fund will not accept the verdict of the Chicago Dental Society and will probably establish a low fee dental clinic which we believe will be a detriment to the public. The human family is so peculiarly constituted that it does not appreciate anything that is easy to obtain. People with moderate incomes who can obtain health service and dental care easily will not appreciate the importance of it and will not have the proper respect for the service rendered. It is because of this fact that we believe dental infirmaries, such as the Forsythe and Eastman, do not accomplish the good they had hoped for so far as educating the patients to appreciate dental service.

We believe the average individual who goes to a low cost dental or medical clinic gets the idea that the service does not amount to much. The people rendering the service do not get the proper respect, and the whole process is one which reacts to the detriment of the patient and to the depreciation of health service.

We are willing to admit that certain provisions should be made to care for people who cannot avail themselves of medical and dental service, but we do not believe that people of moderate incomes should be educated to expect that they can get medical and dental service at a small cost without any great effort or sacrifice on their part.

We believe the establishment of dental clinics to take care of people with moderate incomes is very liable to have the very opposite effect from what the advocates of these clinics believe.

NEWS AND NOTES

American Society of Oral Surgeons and Exodontists

The thirteenth annual meeting of the American Society of Oral Surgeons and Exodontists will be held in Memphis, Tenn., October 16 and 17, 1931. The Elks Hotel will be the headquarters for the meeting.

HOWARD C. MILLER, Secretary,
55 E. Washington Street,
Chicago, Ill.

American Dental Assistants Association

The seventh annual meeting of the American Dental Assistants Association will be held in Memphis, Tenn., October 19 to 22, 1931.

RUTH F. ROGERS, President,
223 W. Jackson Blvd.,
Chicago, Ill.

Seventy-Fifth Anniversary of St. Louis Dental Society

Plans are being made for the celebration of the seventy-fifth anniversary of the St. Louis Dental Society, at Hotel Jefferson, December 7, 8, and 9, 1931.

The Chicago Dental Society Midwinter Meeting

The 1932 Midwinter Meeting of the Chicago Dental Society is to be held at the Stevens Hotel, Chicago, January 18, 19, 20, and 21.

The Program Committee already has in the process of development what promises to be one of the finest programs ever presented before any midwinter meeting of the Society. All members of the American Dental Association and members of recognized foreign dental organizations are cordially invited.

CHARLES R. BAKER, President.
HOWARD C. MILLER, Secretary.

The Dental Society of the State of New York

The Dental Society of the State of New York will hold its sixty-fourth annual meeting May 11, 12, 13, 1932, at Hotel Ten Eyck, Albany, New York. A cordial invitation is extended to all members of state societies, Canadian societies and ethical dentists.

The officers and committees will present a program which we trust will enlist the attention of all dental practitioners.

Dr. E. J. Burkhart, 800 East Main Street, Rochester, N. Y., is Chairman of the Program Committee; Dr. E. W. Briggs, 1116 Madison Avenue, Albany, N. Y., Chairman of the Exhibits Committee; and Dr. E. Burley, 80 Fourth Street, Troy, N. Y., Chairman of the Clinics Committee.

For further information address the Secretary, Dr. A. P. Burkhart.

DR. A. P. BURKHART, Secretary,
57 E. Genesee St.,
Albany, N. Y.

Society for the Advancement of General Anesthesia in Dentistry

The next meeting of the Society for the Advancement of General Anesthesia in Dentistry will be held at Saltzman's 60 E. 42nd Street, in the Lincoln Bldg., New York City, on Monday evening, October 26.

The meeting will open with a dinner at seven o'clock, and the scientific session will commence at eight o'clock.

The essayist of the evening will be Dr. Frank W. Rounds, of Boston, Mass., who will present a talk entitled "Practical Suggestions in Anesthesia for the General Dentist."

Dr. Rounds is President of the American Society of Exodontists and Oral Surgeons, and has earned a well-merited reputation in his specialty.

The officers of the Society who have been elected for 1931-1932 are: James Tayloe Gwathmey, M.D., New York City, Honorary President; M. Hillel Feldman, D.D.S., New York City, President; Irwin Abel, D.D.S., New York City, Vice-President; Leonard Morvay, D.D.S., Newark N. J., Secretary-Treasurer.

Membership is open to all ethical practitioners subscribing to the code of ethics of the American Dental Association.

Reunion and Banquet to Be Held in November

The Baltimore College of Dental Surgery Dental School Alumni of New Jersey will hold a reunion and banquet on November 10 at the Elks Club in Newark, N. J.

Kindly communicate with Bernard Kniberg, secretary, 138 Clinton Ave., Newark, N. J.

St. Louis Study Club of Dentistry

The fourteenth annual session of the St. Louis Study Club of Dentistry will begin Wednesday, October 14, 1931, and will continue every second Wednesday thereafter, eliminating those too near the holidays.

The subjects will be as follow: Dental roentgenology; crown and inlay casting technic; tooth form, cavity preparation and ceramics; conductive and local anesthesia; oral diagnosis and diseases of the mouth; oral bacteriology; dental economics; cast partial dentures; anatomy of the head; public speaking (special course).

These classes will be held on the following dates: October 14 and 28, November 11 and 25, December 9, January 6 and 20, February 3 and 17, March 2.

Particular attention is called to the change in class schedule: meetings will be held every other Wednesday, instead of every Wednesday as in the past.

The St. Louis Study Club of Dentistry Bulletin will be ready for distribution October 1.

Greater New York December Meeting for Better Dentistry

The seventh Greater New York December Meeting for Better Dentistry will be held at the Hotel Pennsylvania, New York City, November 30 to December 4, inclusive.

On Monday, November 30, beginning at 2 P.M., the sessions will open by a joint meeting of physicians and dentists. This will continue through Monday afternoon and evening, and has been arranged by representatives of the five county medical societies, and two district dental societies of Greater New York. There will be three separate subjects, about which papers will be presented by outstanding men in each profession, and each of these papers will be discussed by men of equal eminence, presenting both the medical and the dental aspects. The subjects to be covered are as follows:

1. Relation of Nose, Throat and Ear Diseases to Oral Diseases.
2. Relation of Obstetrics and Pediatrics to Dental Diseases.
3. Relation of Internal Medicine to Oral Diseases.

Beginning Tuesday morning, admission to the Greater New York Meeting for Better Dentistry will be by card only. The following program will be presented:

TUESDAY, DECEMBER 1, 1931

9:30 A.M. to 12:00	Lecture clinics.
2:00 P.M. to 5:00 P.M.	Scientific section meetings.
8:00 P.M.	Scientific papers.

WEDNESDAY, DECEMBER 2, 1931

9:30 A.M. to 12:00	Lecture clinics.
12:30 P.M.	Luncheon in conjunction with the New York Tuberculosis and Health Association.
2:30 P.M. to 5:00 P.M.	Session on children's dentistry.
8:00 P.M.	Scientific papers.

THURSDAY, DECEMBER 3, 1931

9:30 A.M. to 12:00	Lecture clinics.
2:00 P.M. to 5:00 P.M.	Topic discussions.
7:30 P.M.	Table clinics.

FRIDAY, DECEMBER 4, 1931

10:00 A.M.	Manufacturers' clinics.

There will be a manufacturers' exhibit in the hotel during the entire meeting.

JOHN T. HANKS, Chairman,
CARROLL B. WHITCOMB, Vice-Chairman.

Notes of Interest

Dr. Norman J. Whitehill announces the opening of an office at 1904 Pacific Avenue, Atlantic City, N. J. Practice limited to orthodontia exclusively.

Dr. Harold J. Nice announces the removal of his office to the Lister Building, Boston, Mass. Practice limited to orthodontia.

Dr. W. F. Wilson announces that after September 1, 1931, his practice is confined to orthodontia. Office at 10465 Carnegie Ave., Cleveland, Ohio.

Dr. Harvey L. Owen announces the location of his dental office in the suite with his father, Dr. George H. Owen, Metropolitan Building, St. Louis, Mo.

Dr. Eugene J. Kelly announces the opening of offices for the practice of orthodontia at 312 West State Street, Trenton, N. J.

Dr. Floyde Eddy Hogeboom announces the opening of new offices in the Pellissier Building, Los Angeles, Calif. Dr. Hogeboom will devote special attention to oral hygiene, operative dentistry for children, and orthodontia. Dr. Ellen Jane Crump, associate, preventive dentistry and prophylaxis.

Dr. Brinton L. Warner announces the removal of his office to the Ancon Dispensary, Ancon, Canal Zone.

Dr. Archie Brusse announces the removal of his office to 1578 Humboldt Street, Denver, Colo.

Dr. J. Lyndon Carman announces the removal of his office to 1578 Humboldt Street, Denver, Colo.